Deschutes County
Transportation System Plan

2010 - 2030

Adopted by Ordinance 2012-005
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By The Deschutes County Board of Commissioners

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Cover photo of Paulina Peak by Peter Russell

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The contents of this document do not necessarily reflect views or policies of the State of Oregon.

Executive Summary

Deschutes County adopted its original Transportation System Plan (TSP) in August 1998, encompassing 1996-2016. In the intervening years, the County and its cities saw rampant population growth and associated increases on the State highways and County road segments, particularly those near Bend and Redmond. The County began a TSP update in 2007, incorporating changes in population, traffic volumes, rise of non-automotive modes, and diminishing available funding at the federal, state, and local levels for projects. The TSP update spans 2010-2030 and lists $306.2 million in projects.

The TSP provides a roadmap to meet the needs of air, automobile bicycle, freight, pedestrian rail, transit and other modes. A combination of technical analysis, coordination with Oregon Department of Transportation (ODOT), coordination with the four cities within the County, public outreach, and local knowledge identified those needs. The TSP prioritizes projects into high (0-5 years), medium (6-10 years) and low (11-20 years) categories and provides planning-level cost estimates. The distribution of the 94 projects, excluding those on the Illustrative List is:

- High Priority: 20 projects
- Medium Priority: 31 projects
- Low Priority: 43 projects

The TSP contains background information on the major land use and transportation changes since 1998 as well as the approximately 832 miles of County-maintained roads. Of those 832 miles, 693 are paved and 139 are unpaved. Additionally, the County contains another 471 miles of public roads not maintained by the County but which the County still has jurisdiction. Of the 310 miles of County arterials and collectors only 13% (40 miles) carry more than 3,000 or more average daily trips (ADT). The County's standard is 9,600 ADT. ODOT has approximately 200 miles of State highways in the County. The bulk of vehicles moving in the County are traveling on the State system, with ADTs in the rural sections approaching 18,000; 6,000 ADTs are considered high for a County road. Volume is just one aspect of a transportation system, another is the operational safety. In the transportation industry, a crash rate of less than 1.0 per million miles of vehicles miles traveled (VMT) is acceptable. Similarly, for an intersection a crash rate of less than 1.0 million entering vehicles (MEV) is acceptable. Acceptable means the crash rates are indicative of random events and not a systematic problem. Crash data for County road segments and intersections indicate only three segments totaling 11.1 miles had a crash rate of more than 1.0 per million VMT and 10.2-segment had a rate of 0.89, which should be monitored. No County intersection exceeded a crash rate of 1.0 per MEV.

The TSP also examines non-automotive modes, including air, bicycle, freight, pedestrian, public transit, and rail. While the County's 700 miles of paved and maintained roads offer a safe and efficient route for both bicycle commuters and recreational riders, the cycling community supported a network of County- and State-designated bikeways. The Road Department would use the bikeway designation as a tiebreaker when considering improvements to roads with roughly similar functional classification, pavement condition index (PCI), and average daily traffic (ADT). Additionally, a bikeway designation could aid the County or other third parties seeking grant funding for road improvements.

The bulk of freight shipments in the County travel on the State highway system as do most vehicles.. The County has proposed roundabouts as a low-cost and safe improvement for several County-County road intersections as well as two County road-State highway intersections east of Bend. The County recognizes the use of roundabouts on the State highway system is ultimately a decision by the Oregon

Department of Transportation (ODOT). However, the County will use the cost of a rural roundabout as the baseline for the percentage of the County's financial contribution to improving County-State highway intersections. The County will work with the air, rail, and truck shippers to identify issues, opportunities, and constraints on moving freight to and through the County.

In 2010, Deschutes County had a total population of 157,733 of which 66% was urban and 34% was rural. The plurality of the urban population resided in either Bend (76,639) or Redmond (26,215), which are linked by the approximately 16 miles of US 97. By 2030, the County's population is expected to reach 266,539, an increase of 108,806 or 69 percent. The urban/rural split will remain essentially the same with 67% residing in cities and 33% on unincorporated lands. Bend (119,009) and Redmond (51,733) will remain the County's largest cities by a substantial margin.

Forecasting future traffic volumes and their distribution was based on a combination of expected population growth, employment growth, traffic data, and modeling time spent traveling between attractors and generators. ODOT prepared the State's first traffic model for a rural county, basing it on the pre-existing Bend and Redmond traffic models and dividing the rural county into 260 transportation planning analysis zones (TAZs).

The 2030 forecast volumes demonstrated the majority of the roadway segments or intersections that will need improvement occur on the State system, primarily on US 97 from Terrebonne to Redmond and Sunriver to La Pine; US 20 from Black Butte to Sisters and Tumalo to Bend; and OR 126 on the east and west fringe of Redmond. For County roads, a few short segments on the margins of Bend and Redmond will need improvements as well as a few intersections, primarily on the eastern edge of Bend; the west side of Redmond; the west edge of La Pine.

Deschutes County conducted extensive public outreach during the development of TSP, including three rounds of open houses around the County. The first round was a kick off to allow the public to identify local issue. The second round was to present technical reports on existing conditions and forecast traffic volumes, listing resulting deficiencies. The third round identified future projects and other transportation improvements. Additionally, the County held work sessions and public hearings before the Planning Commission and the Board of County Commissioners. Staff also participated in multiple community, homeowner, local associations, and the County's Bicycle and Pedestrian Advisory Committee (BPAC) meetings.

During the outreach described above, the public and other stakeholders raised the following issues:

- High speeds and/or cut-through traffic in rural communities and/or rural subdivisions
- Better accommodations for cyclists, including non-highway options between Bend and Sisters
- Creating a trail network between 1) Bend and Redmond to Smith Rock State Park; 2) Bend and Sisters; and 3) Bend and Sunriver
- Desire for various gravel roads to be paved
- Concerns about condition of various roads
- Safety issues at various intersections in the Bend, La Pine, Redmond, Terrebonne, Tumalo areas
- Secondary access to isolated subdivisions in South County
- Winter driving conditions on both County-maintained roads and State highways
- Desire to add local access roads to County-maintained system
- Traffic impacts of destination resorts

The TSP continues the support the evolution of State highways, particularly US 97, from two-lane roads with multiple direct accesses to an Expressway with frontage roads and grade-separated interchanges. The evolution is accomplished via an iterative "four-phase" approach that includes adding passing lanes which are later knitted together and adding raised medians.

The TSP meets the requirements of the Transportation Planning Rule (TPR) which implements Goal 12 of the statewide planning program. The TSP provides technical analysis to identify deficiencies and projects and/or policies to correct those deficiencies; prioritizes projects; and produce planning-level cost estimates over the 20-year life of the plan. The TSP addresses all modes.

The TSP planning-level cost estimates are summarized below; the list does not include projects from the Plan's illustrative list (projects either not needed in the next 20 years or not expected to be funded).

- $306.2 million for all projects (County roads and bridges, State highways, bike/ped, etc.)
- $240.6 million for State highway projects
- $61.3 million for County road projects
- $3.4 million for County bridge projects

Winnowing the projects to only those identified as high priority results in:

- $107.1 million for all high priority projects (County and State)
- $75.9 million for State highway projects
- $29.7 million for all County road projects
- $1.5 million for County bridge projects

Neither the State nor the County has adequate funding to construct the $306 million of projects identified in the TSP. Limiting the projects to the $107 million of high priority projects still presents a formidable challenge, even spread over two decades. The State would need to raise nearly $3.8 million every year for 20 years and the County would need approximately $1.5 million annually for the same time period. Additionally, this does not consider the County's backlog of roads needing operations, maintenance, and preservation which also requires increased funding.

At the time of this study, the Road Department is currently able to budget $3.8M annually for pavement maintenance and preservation in the form of overlay and chip seal. The funding amount necessary to sustain the existing pavement condition is approximately $5.4M based on an overlay interval of 30-years with mid-cycle chip seal surfacing approximately every seven years. At the rate of current investment, approximately $1.6M in annual maintenance cost is deferred annually.

In the fall of 2011, the Board of County Commissioners convened a special Road Committee to evaluate operations and investment levels within the Road Department. The Committee developed five recommendations – with the fifth recommendation to explore alternative funding sources. The Committee was clear that the first four recommendations, which are focused on improved asset management efforts, internal efficiencies and regional partnerships, should be fully explored and exhausted before proceeding with alternative funding source development.

The goals and policies to coordinate and implement the TSP are as follows:

COORDINATION AND IMPLEMENTATION

Goal 1

1. Achieve an efficient, safe, convenient and economically viable transportation and communication system. This system includes roads, rail lines, public transit, air, pipeline, pedestrian and bicycle facilities. The Deschutes County transportation system shall be designed to serve the existing and projected needs of the unincorporated communities and rural areas within the County. The system shall provide connections between different modes of transportation to reduce reliance on any one mode.

Policy 1

1.1. Deschutes County shall protect approved or proposed transportation project sites through:

a. Access control measures;

b. Review of future large development and transportation projects that significantly affect the County's transportation system;

c. Requirement of conditions of approval on developments and transportation projects that have a significant effect on the County's transportation system.

d. Collection of transportation System Development Charges (SDCs) for approved land uses as proscribed under BOCC Resolution 2008-059

1.2. The lead agency for review of transportation projects in Deschutes County shall be:

a. Deschutes County for projects completely outside UGBs;

b. The affected city for projects within its UGB; and

c. The State of Oregon, Deschutes County and affected cities on projects involving state-owned facilities that are both inside and outside of a UGB.

Goal 2

2. The Deschutes County TSP shall be continually updated in a timely fashion in order to ensure the transportation system serves the needs of County residents, businesses, and visitors.

Policy 2

2.1. Deschutes County shall:

a. Identify local, regional and state transportation needs;

b. Develop a transportation plan that shall address those needs;

c. Review and update the plan at least every five years;

d. Continue to coordinate transportation planning with local, regional and state plans by reviewing any changes to Deschutes County local transportation plans, regional transportation plans, the Oregon Transportation Plan and ODOT's State Transportation Improvement Program (STIP); and

e. Continue public and interagency involvement in the transportation planning process.

2.2. Transportation Projects

a. The County shall have a list of transportation projects, adopted by the Board of County Commissioners in accordance with the policies set forth below.

b. The initial Transportation Project List shall be set forth in Table 5.11.T1 of the Transportation System Plan adopted as part of the Resource Element of the Comprehensive Plan. The Board shall update the Transportation Project List periodically by resolution adopted by the Board, without need of a formal amendment to the TSP.

c. New transportation projects shall be included on the County's Transportation Project List. A transportation project proposed for addition to the list shall be subject to an individual land use review only if applicable administrative rules or land use regulations require such review.

d. Transportation or development projects that require a plan text amendment or a conditional use permit may be required to fulfill conditions or implement mitigation measures before approval is granted. Mitigation and conditions may include, but are not limited to:

- Improvement of surrounding roads;
- Limits on level of development;
- Revision of development placement;
- Addition or redesign of access;
- Addition of traffic management devices such as traffic signals, medians, turn lanes or signage; and/or
- Improvements that reduce transportation impacts.

Deschutes County acknowledges that land use designations have a significant impact on the overall transportation system and any alterations shall be completed with consideration to traffic impacts on the County road system and consistency with the TPR.

Goal 3

3. The transportation plan and facilities of Deschutes County shall be coordinated with the plans and facilities of incorporated cities within Deschutes County, adjacent counties and the State of Oregon.

Policy 3

3.1. Deschutes County shall notify ODOT concerning:

a. All land use proposals or actions that would create access onto a state highway or add more than100 ADT to any County road intersection with a state highway;

b. Any proposed land use or development within 500 feet of a state highway or public use airport within the County; and

c. Require ODOT road approach permits.

3.2 Deschutes County shall coordinate local plans and land use decisions with state transportation plans, including the Oregon Transportation Plan, the Oregon Highway Plan and other modal plans. These plans provide ODOT policies and performance standards for State Highways within Deschutes County. These ODOT plans also provide the framework for access management on state facilities to protect the capacity and function of the highways.

3.3. The findings of compliance with applicable statewide planning goals, acknowledged comprehensive plan policies and land use regulations, shall be coordinated with the preparation of any Environmental Impact Statement (EIS) required for a proposed transportation facility that is identified on the Deschutes County Transportation System Plan.

ARTERIAL AND COLLECTOR ROAD PLAN

Goal 4

4. Establish a transportation system, supportive of a geographically distributed and diversified economic base, while also providing a safe, efficient network for residential mobility and tourism.

Policies

4.1. Deschutes County shall:

a. Consider the road network to be the most important and valuable component of the transportation system; and

b. Consider the preservation and maintenance and repair of the County road network to be vital to the continued and future utility of the County's transportation system.

4.2. Deschutes County shall not add any miles of new arterials or collectors to the County road system unless the following issues are satisfied:

a. The need for the road can be clearly demonstrated;

b. The County can financially absorb the additional maintenance requirements;

c. The condition of the road proposed for acceptance into the County system must meet County road standards;

d. An accrued benefit can be shown to the County's economic growth;

e. The Board determines there have been adequate replacement revenues to off the loss of timber payments from the federal program;

f. An overall increase in efficiency in the County road network can be demonstrated.

4.3 Deschutes County shall make transportation decisions with consideration of land use impacts, including but not limited to, adjacent land use patterns, both existing and planned, and their designated uses and densities.

4.4 Deschutes County shall consider roadway function, classification and capacity as criteria for plan map amendments and zone changes. This shall assure that proposed land uses do not exceed the planned capacity of the transportation system.

4.5 Roads in Deschutes County shall be located, designed and constructed to meet their planned function and provide space for motor vehicle travel and bike and pedestrian facilities where required.

4.6 Deschutes County shall manage the development process to obtain adequate street right-of-way and improvements commensurate with the level and impact of development. New development shall provide traffic impact analysis to assess these impacts and to help determine transportation system needs. The guidelines for traffic impact analysis shall be located within Deschutes County Code ("DCC") Chapter17.48, Deschutes County Road Design and Specification Standards.

4.7. Transportation system improvements in Deschutes County shall comply with the Americans with Disabilities Act.

4.8 Transportation safety in Deschutes County shall be improved for all modes through approved design practice and sound engineering principles.

4.9 Deschutes County shall acquire the necessary right-of-way through the development process to correct street intersections, substandard road geometry or other problems in order to improve the safety of a road alignment, consistent with constitutional limitations.

4.10 Deschutes County shall support efforts to educate the public regarding hazards related to travel on the transportation system.

4.11 Deschutes County shall support public and private efforts to acquire right-of-way for new secondary access roads to isolated subdivisions.

ACCESS MANAGEMENT

Goal 5

5. Maintain an access management system adequate to protect the quality and function of the arterial and collector street system.

Policies

5.1 Deschutes County shall designate access and land uses appropriate to the function of a given road.

5.2 Deschutes County shall require new development to minimize direct access points onto arterials and collectors by encouraging the utilization of common driveways.

5.3 Wherever practical, access to state highways shall be provided via frontage roads, alternative local roads or other means, rather than direct access to the highway.

5.4 A non-traversible median on state highways shall be installed by ODOT when operational or safety issues warrant installation as set forth by Policy 3B: Medians in the *Oregon Highway Plan*. Directional breaks in the median may be allowed as needed, provided traffic operations are still safe.

5.5 Access requests onto Deschutes County arterials and collectors for new partitions, subdivisions and commercial and industrial development shall be processed with the following access management classification system in mind:

a. Public road access spaced at no less than every 500 feet on arterials and 300 feet on collectors.

b. If either safety or environmental factors, or the unavailability of adequate distance between access points requires placing access points at lesser intervals, then access shall be denied or the best alternative placement shall be chosen. On road segments that are already severely impacted by numerous access points or on road segments that abut exception areas, adherence to the above standards may be either unreasonable or counterproductive to infill of exception areas. In such cases, these standards may be relaxed by the County Road Department Director to accommodate the aforementioned special conditions.

FUNCTIONAL CLASSIFICATION

Goal 6

6. Designate access and land uses appropriate to the function of a given road.

Policies

6.1 Deschutes County shall:

a. Coordinate the County Transportation System Plan with the transportation system plans of the cities of Bend, La Pine, Redmond and Sisters. The County shall emphasize continuity in the classification of roads and appropriate design standards for roads that link urban areas with rural areas outside the urban growth boundaries. The County and affected city shall agree on the functional classification and design standards of County roads within the proposed UGB area.

b. Request the transfer of, or an agreement to transfer with specific timelines and milestones, jurisdiction of County roadways within the urban growth boundaries to their respective cities at the time of annexation. County policy also directs that any developer of property who proposes annexation and who has frontage on a road that does not meet city standards shall have the primary responsibility for upgrading the road to applicable city specifications. Roads shall be upgraded prior to or at the time of annexation, or the developer shall sign an agreement with the city to upgrade the road, at the time of development. Transfer of road jurisdiction shall require the approval of both the County and affected city in accordance with the provisions in ORS 373.270.

c. Future roads outside of city limits but within Urban Growth Boundaries shall have right-of-way dedications sufficient to meet the relevant city standards, but the road shall be constructed to County standards. The County will support a developer who chooses to build the road to the full urban standards of the relevant city instead of to County standard.

d. Coordinate the County Transportation System Plan with surrounding counties' TSPs.

ROAD AND STREET STANDARDS

Goal 7

7. Update as needed DCC Chapter 17.48, Design and Construction Specifications, to ensure all aspects of construction related to roads, pedestrian walkways and bicycle facilities occurring outside designated urban growth boundaries in Deschutes County are adequate to meet the needs of the traveling public.

Policies

7.1 Any new or reconstructed rural roads shall be built to the standards set forth in DCC Chapter 17.48, Table A. Bicycle and pedestrian facilities shall be built to the standards set forth in DCC Chapter17.48, Table B.

7.2 Road, pedestrian and bicycle projects occurring in unincorporated areas within urban growth boundaries shall be governed by the respective city's road and street standards. Those requirements shall be coordinated between the city, the County and the applicant during the land use process according to procedures to be identified in the Deschutes County Road Standards and Specifications document.

7.3 Review every three to five years the adopted criteria in DCC 17.16.115 for the requirement of various levels of traffic analysis for each new rural development.

ROAD MANAGEMENT SYSTEM

Goal 8

8. Maintain the County road network pavement in good to excellent condition.

Policies

8.1 Deschutes County shall continue to maintain and preserve the County road network through its pavement management system which guides a program of paving, repairing, reconstruction, drainage clearance and vegetation control.

8.2 After safety-related issues, the highest volume road segments shall be the next priority for County road maintenance and repair.

8.3 If and when gravel or dirt roads are paved by the County, the main controlling criteria shall be: re-establishment of adequate funding for long-term maintenance, density of surrounding development, traffic volumes, road classification, gap filling, potential school bus routing efficiency and emergency evacuation potential.

PERFORMANCE STANDARDS

Goal 9

9. Maintain a level of service of "D" or better during the peak hour throughout the County arterial and collector road system over the next 20 years.

Policies

9.1 Deschutes County shall continue to monitor road volumes on the County arterial and collector network. The County Road Department shall continue to be the department responsible for monitoring volumes and shall strive to count each arterial and collector at least once every four years. The Road Department shall periodically examine the traffic volumes to identify level of service deterioration.

Goal 10

10. Maintain the current arterial and collector system in the County and prevent degradation of the capacity of the system.

Policies

10.1 Deschutes County shall monitor County arterials and collectors to help in the determination of when road improvement projects are necessary.

10.2 Deschutes County shall continue to work with the ODOT, the Cities of Bend, La Pine, Redmond and Sisters, and neighboring counties to coordinate solutions to highway and non-highway road issues that cross over jurisdictional boundaries.

10.3 The County shall establish requirements and adopt standards for secondary access roads to isolated rural subdivisions.

BRIDGES

Goal 11

11. Maintain a safe and efficient network of bridges on County roadways.

Policies

11.1. Deschutes County shall monitor the condition of County bridges on a regular basis, and perform routine maintenance and repair when necessary. The County shall also explore additional funding sources when major reconstruction or replacement of bridges is necessary.

TRUCK ROUTES

Goal 12

12. Develop a plan of designated truck routes on County arterials.

Policies

12.1. Deschutes County shall designate that long-haul, through trucks, be limited to operating on Principal Arterial and Rural Arterial roads as designated in the County transportation network, except in emergency situations and when no reasonable alternative arterial road is available for access to commercial or industrial uses.

12.2 Deschutes County shall support economic development by encourjaging ODOT to prioritize modernization, preservation, and safety projects on highways designated as Freight Routes over non-Freight Routes

FACILITY/SAFETY MANAGEMENT

Goal 13

13. Maintain a safe and efficient network of roadways.

Policies

13.1 Deschutes County shall develop and maintain a prioritized inventory of safety-deficient facilities on the County road network and give highest priority to correcting safety issues.

PUBLIC TRANSPORTATION PLAN

Goal 14

14.1 Enhance the opportunity for intermodal connections throughout the County transportation system, and actively support the provision of public transportation throughout the County.

14.2 Increase the existing level of special services provided.

14.3 Establish rural transit service for Deschutes County residents.

14.4 Decrease barriers to the use of existing public transportation services.

Policies

14.1 Deschutes County shall work with ODOT, the cities of Bend, La Pine, Redmond and Sisters, and transit service providers to study Countywide rideshare facility needs, and investigate public transit possibilities including potential transit stops for a regional or commuter-based transit system. Those possibilities shall include bus and rail, and if economically feasible, the County shall seek services that are safe, efficient, and convenient in serving the transportation needs of the residents of Deschutes County.

14.2 Deschutes County shall continue to work with special service providers, ODOT, and the cities of Bend, La Pine, Redmond and Sisters to secure additional funding as well as increase promotion of those special transit services that may be underutilized.

14.3 Deschutes County shall identify and monitor the needs of the transportation disadvantaged and attempt to fill those needs.

Bikeway and Pedestrian Plan

Goal 15

15.1. Review every three to five years the adopted, Countywide system plan for bike and pedestrian facilities to ensure continued access to various destinations within unincorporated communities and between urban areas and unincorporated communities.

15.2 Provide and maintain a safe, convenient and economical bicycle and pedestrian system that is integrated with other transportation systems.

15.3 Support bicycle safety, education and enforcement programs for all ages, improve riding skills, achieve observances of traffic laws, increased awareness of cyclists' and pedestrians' rights, and monitor and analyze bicycle accident data to determine safety problem areas.

15.4 Coordinate on-road County bikeways with known existing and proposed State and City bikeways.

15.5. Work with Bike-Pedestrian Advisory Committee (BPAC) to identify a system of off-road paved and non-paved shared-use paths to be included in the County transportation system.

15.6 Maintain the existing development requirements for bicycle facilities in Deschutes County.

Policies

15.1 Deschutes County shall coordinate local plans for pedestrian and bicycle facilities with the most current edition of the *Oregon Bicycle and Pedestrian Plan.* The statewide plan provides a framework for a local bicycle and pedestrian system and design standards.

15.2 Deschutes County shall require bike facilities at locations that provide access within and between residential subdivisions, schools, shopping centers, industrial parks, and other activity centers when financially feasible.

15.3 Deschutes County shall:

a. Balance the plan with a variety of facilities to meet the needs of different cyclists;

b. Plan for bicycle access between the County's urban and rural areas;

c. Develop a bikeway system, to be updated semi-annually and including a map for the public that describes the opportunities for bicycling in Deschutes County;

d. Establish priorities for facility construction and maintenance based on need and resource availability;

e. Evaluate the plan regularly to monitor how well the facilities meet the goals of the Plan;

f. Upgrade rural road shoulder widths to County standards during road modernization or maintenance projects involving overlays as funding allows, provided no additional purchase of right-of-way is required or substantial cut and fill or grading is needed;

g. Require bicycle and pedestrian facilities to satisfy the recreational and utilitarian needs of the citizens of Deschutes County;

h. Make potential use, safety and the cost of bikeway construction, the primary considerations when designing specific bikeways;

i. Emphasize the designation of on-road bikeways, where conditions warrant due to safety reasons and the cost of construction and maintenance of separate bike paths;

j. Expend resources for the maintenance of existing bikeways and to keep pace with the development of new bikeways;

k. Designate that the Deschutes County Bicycle and Pedestrian Advisory Committee facilitate the coordination of all bicycle and pedestrian planning in the County to assure compatibility;

l. Designate that the Deschutes County Bicycle and Pedestrian Advisory Committee assure that the Plan remains up-to-date and that implementation proceeds according to the Plan;

m. Work with affected jurisdictions to acquire, develop, connect, and maintain a series of trails along the Deschutes River, Tumalo Creek, and the major irrigation canals so that these features can be retained as a community asset;

n. Adopt standards for trail system right-of-ways and trail improvements that are based on the type of planned trail use and reflect the standards of the most recent version of the *Oregon Bicycle and Pedestrian Plan*;

o. Pursue grant opportunities to plan or construct the Tumalo Trail between Tumalo State Park and the unincorporated community of Tumalo;

p. Work cooperatively with City parks and recreation districts to support grant applications to build or maintain trails in the rural County whether on public or private lands; and

q. Support the implementation of the Three Sisters Scenic Bikeway plan.

15.4. New public and private land developments in Deschutes County shall accommodate and tie into the bicycle system, and shall provide their residents and employees with appropriate bicycle facilities.

15.5 County arterials and collectors may use shoulder bikeways or shared roadways. These bikeways shall be upgraded to bike lanes when highway reconstruction occurs and the traffic volumes warrant lanes.

15.6 Deschutes County shall facilitate safe and direct bicycle and pedestrian crossings of arterial roads.

15.7. On-road bikeways shall be constructed in accordance with the specifications set forth in DCC Chapter 17.48, Table A.

15.8 Developers in Deschutes County shall be encouraged to design paths that connect to the Countywide bikeway system and that provide the most direct route for commuters. In some cases, it may be appropriate to relax a requirement, such as for a sidewalk on one side of a residential street, in favor of a comparable and relatively parallel bike path within the development. However, the developer's provision of a bike path shall not change the on-road bikeway requirement for arterials and collectors.

15.9 Deschutes County shall facilitate the development of mountain bike routes and the creation of paved off-road shared-use paths. The County shall work with its public agency and non-profit partners and the County Bicycle and Pedestrian Advisory Committee (BPAC) to identify such routes and incorporate them into its transportation system where appropriate. Particular

attention shall be given to obtaining and keeping rights-of-way for uninterrupted routes linking various residential, commercial, resort, and park areas within the County. Linear corridors such as rivers, irrigation canals, ridges and abandoned roadway and rail lines shall receive special attention. Proposed developments may be required to provide such identified trail and path rights-of-way as part of their transportation scheme in order to maintain the integrity and continuity of the Countywide system.

15.10 The County shall work with local agencies, jurisdictions, and affected property owners to acquire, develop, address trail-connectivity issues and maintain only those sections of trail that are located outside of UGBs that are consistent with the County's TSP but are part of a trail plan or map that has been adopted by the local jurisdiction and/or the County. Staff will work with local, state, federal agencies, and BPAC to determine the priority for trails that connect urban and rural areas.

15.11 Off-road paved shared-use paths shall be constructed in accordance with the guidelines set forth in the most current edition of the *Oregon Bicycle and Pedestrian Plan*.

15.12 Deschutes County shall maintain and update as necessary, the existing ordinance requirements for bicycle facilities found in DCC 18.116.031 and DCC Chapter 17.48, Table B, or such other location that it may be moved to within the Deschutes County Development Code.

AIRPORT PLAN

Goal 16

16. Protect the function and economic viability of the existing public-use airports, while ensuring public safety and compatibility between the airport uses and surrounding land uses for public use airports and for private airports with three or more based aircraft.

Policies

16.1 Deschutes County shall protect public-use airports through the development of airport land use regulations. Efforts shall be made to regulate the land uses in designated areas surrounding the Redmond, Bend, Sunriver and Sisters (Eagle Air) airports based upon adopted airport master plans or evidence of each airports specific level of risk and usage. The purpose of these regulations shall be to prevent the installation of airspace obstructions, additional airport hazards, and ensure the safety of the public and guide compatible land use. For the safety of those on the ground, only limited uses shall be allowed in specific noise impacted and crash hazard areas that have been identified for each specific airport.

16.2. Deschutes County shall:

a. Continue to recognize the Redmond (Roberts Field) Airport as the major commercial/passenger aviation facility in Deschutes County and an airport of regional significance. Its operation, free from conflicting land uses, is in the best interests of the citizens of Deschutes County. Incompatible land uses shall be prohibited on the County lands adjacent to the airport;

b. Cooperate with the cities of Bend, Redmond and Sisters in establishing uniform zoning standards, which shall prevent the development of hazardous structures and incompatible land uses around airports;

c. Take steps to ensure that any proposed uses shall not impact airborne aircraft because of height of structures, smoke, glare, lights which shine upward, radio interference from transmissions or any water impoundments or sanitary landfills which would create potential hazards from waterfowl to airborne aircraft;

d. Allow land uses around public-use airports that shall not be adversely affected by noise and safety problems and shall be compatible with the airports and their operations;

e. Work with, and encourage airport sponsors to work with the Federal Aviation Administration (FAA) to enforce FAA-registered flight patterns and FAA flight behavior regulations to protect the interests of County residents living near airports.

f. Adopt regulations to ensure that developments in the airport approach areas shall not be visually distracting, create electrical interference or cause other safety problems for aircraft or persons on the ground. In addition, efforts shall be made to minimize population densities and prohibit places of public assembly in the approach areas;

g. Continue efforts to prevent additional residential encroachment within critical noise contours or safety areas without informed consent;

h. Specifically designate any proposed airport facility relocations or expansions within County jurisdiction on an airport master plan or airport layout plan map, as amended, and establish the appropriate airport zoning designation to assure a compatible association of airport growth with surrounding urban or rural development;

i. Maintain geographic information system (GIS) mapping of the Airport Overlay Zones and provide timely updates;

j. For those airports in Deschutes County without adopted master plans, the County shall, as a minimum, base any land use decisions involving airports on DCC Chapter 18.80 and Oregon Administrative Rule Chapter 660, Division 13, Airport Planning;

k. Participate in and encourage the County-adoption of airport master plans for all public use airports and at least an airport layout plan for the remaining State-recognized airfields in Deschutes County;

l. Encourage appropriate federal, state and local funding for airport improvements at public-owned airports; and

m. Discourage future development of private landing fields when they are in proximity to one another, near other public airports and potential airspace conflicts have been determined to exist by the Federal Aviation administration (FAA) or the Oregon Department of Aviation.

RAIL PLAN

Goal 17

17.1 Maintain the existing levels of freight rail activity throughout the County while also encouraging expanded usage by commercial and industrial companies.

17.2. Increase the safety of existing at-grade crossings and work towards the eventual replacement of all at-grade crossings with gate-protected or grade-separated crossings according to the prioritized list from the 2009 *Report on Central Oregon Rail Planning.*

17.3. Re-establish passenger rail service to Central Oregon as soon as practical.

Policies

17.1 Deschutes County shall:

a. Work cooperatively with affected local jurisdictions and railroad operators to reduce land use conflicts and increase safety at all at-grade crossings;

b. Encourage efforts to improve the condition of rail lines throughout the County in order to retain the effectiveness and competitiveness of freight rail;

c. Not endorse the abandonment of any rail lines unless they are to be converted to trail use through the federal "Rails to Trails" program. Once converted, the trails shall be incorporated into the County Bikeway/Trail System;

d. Not endorse any activities that would diminish existing rail service; and

e. Work cooperatively with affected local jurisdictions, businesses and railroad operators to protect all rail spurs that currently serve businesses or have the potential to serve freight rail uses from abandonment or incompatible zoning.

17.2. Deschutes County shall work cooperatively with ODOT, area cities, and rail providers to identify and prioritize the actions needed to provide passenger rail service on the US 97 corridor.

TRANSPORTATION SYSTEM AND TRANSPORTATION DEMAND MANAGEMENT

Goal 18

18.1 In order to optimize the carrying capacity of the County road system, provide cost effective transportation improvements and implement strategies that shall improve the efficiency and function of existing roads.

18.2 Reduce peak hour traffic volumes on County roads and diminish the exclusive use of single-occupant vehicles.

Policies

18.1 Deschutes County shall adopt land use regulations to limit the location and number of driveways and access points on all collector and arterial roads;

18.2 Deschutes County shall ensure that land use actions support the access management policies of the Oregon Department of Transportation (ODOT) along State highways.

18.3 Deschutes County shall implement transportation system management measures to increase safety and reduce traffic congestion on arterial and collector streets, and protect the function of all travel modes.

18.4 Deschutes County shall promote safety and uninterrupted traffic flow along arterials via the following planning considerations:

a. Clustering of all types of development and provisions for an internal traffic circulation pattern with limited arterial access shall be encouraged;

b. A minimum setback of 50 feet from arterial rights-of-way shall be required;

c. Recommendations on speed limits shall be forwarded to the State Speed Control Board.

18.5 Deschutes County shall:

a. Encourage businesses to participate in transportation demand management efforts through the development of incentives and/or disincentives. These programs shall be designed to reduce peak hour traffic volumes by encouraging ridesharing, cycling, walking, telecommuting, alternative/flexible work schedules and transit use when it becomes available;

b. Work with business groups, large employers and school districts to develop and implement transportation demand management programs;

c. Continue to support the work of non-profit agencies working towards the same TDM goals as Deschutes County;

d. Encourage programs such as van or carpooling (rideshare) to increase vehicle occupancy and reduce unnecessary single-occupant vehicle travel;

e. Continue to pursue the development of park and ride facilities and consider the siting of a rideshare facility, based on identified needs, when realigning County roadways, considering the sale of surplus property, or reviewing land use applications for developments that could benefit from such a facility;

f. Pursue the development and utilization of telecommunication technologies that facilitate the movement of information and data;

g. Support efforts to educate the public regarding the actual costs related to travel on the transportation system and encourage transportation demand management alternatives; and

h. Establish and make available a transportation demand management program to County employees, to serve as a role model for the community.

CHAPTER ONE

Introduction

The State of Oregon requires cities and counties to comply in their comprehensive plans with 19 Statewide Planning Goals, of which Goal 12 is Transportation. Oregon Administrative Rule (OAR) Chapter 660 Division 12, Transportation Planning, implements Goal 12. OAR 660-012 is known as the Transportation Planning Rule (TPR) and requires cities and counties to prepare Transportation System Plans (TSPs) that have 20-year planning horizons. The TSP is the Transportation element of the Comprehensive Plan. The TSP must encompass all modes to ensure Oregonians have a transportation network at the state and local level that is safe, convenient, and economical as it serves their needs. The transportation network should provide a variety of modal choices and serve the transportation disadvantaged. Deschutes County adopted its first TSP in 1998 and began to update the TSP in January 2007.

1.1 Geographic Setting

Deschutes County encompasses 3,055 square miles of widely varied terrain, ranging from the snow-capped crest and timbered slopes of the Cascade Range on the west to the sagebrush ocean of the High Desert to the east. (Figure 1.1.F1) The combination of mountains, lakes, rivers, open desert and a proximity of less than three hours driving time to each of the Willamette Valley's three major population centers (Portland, Salem, and Eugene) has long made Deschutes County a recreational destination. The County, which was formed in 1916, also lies approximately midway between Washington and California.

The County's economy, like many other counties in the intermontane West, had long relied on timber and cattle with some agriculture. In recent decades, the County has relied more on tourism. An average of 12 inches of rain a year and a base elevation of approximately 3,600 feet may make farming a difficult endeavor, but those limiting factors for agriculture become positives for hunting, fishing, downhill and cross-country skiing, off-roading, and hiking. Yet, the County also contains areas of manufacturing, rural industry, manufacturing, and research.

The County's physical and recreational amenities led to a nearly two-decade population boom. According to the 2010 US Census, the County had a total population of 157,733; by comparison in 1995 the County had a certified population of 94,100.

The County's population resides in four incorporated cities Bend (76,639), Redmond (26,215), Sisters (2,038), and La Pine (1,653) and an unincorporated area totaling 51,188. In other words, about 65% of the County's population is urban and 35% is rural. Bend and Redmond are the two most populous cities in the eastern two-thirds of the state and Bend is the only Metropolitan Planning Organization (MPO) east of the Cascades.

The main highways to Deschutes County are US 97, which is the major north-south highway on the east side of the Cascades, US 20/OR 22 from the mid-Willamette Valley, OR 126 from the Upper Willamette Valley, and US 20 and OR 31 from eastern Oregon.

The bulk of the vehicle movements in Deschutes County occurs on the state highway system, particularly on US 97 between Redmond and Bend, US 20 between Sisters and Bend, and US 97 between Bend and Sunriver. US 97 leads north roughly 113 miles to Interstate 84 and the Columbia Gorge and south approximately 152 miles to California.

1.2 Transportation Planning

The Deschutes County Transportation System Plan (TSP) synthesizes the transportation information, population, and land use patterns to identify short to long-term transportation needs. The timelines are defined as follows. Short-term is 0-5 years; mid-term is 6-10 years; and long-term is 11-20 years. The TSP in the short-term identifies and provides recommended solutions to immediate safety, operational, and congestion problems. For the 20-year planning horizon, the TSP identifies goals and policies and prioritizes projects to ensure the movement of people, goods, and services through the County. The Deschutes County TSP was coordinated with the TSPs for the cities within the County and with various state modal plans, including air, auto, bicycles, freight, pedestrian, pipeline, rail, and transit. The plan reflects existing land use plans, policies, and regulations that affect the transportation system and includes financial assumptions and concepts on how to finance future projects

Goal 12

Goal 12 is the transportation goal in the nineteen separate statewide planning goals adopted by the State of Oregon in the 1970's. These goals were designed to be implemented through inclusion in regional and local comprehensive plans. Under Goal 12, local governments, regions and metropolitan areas (MPOs) must adopt transportation plans which:

> "...provide and encourage a safe, convenient and economic transportation system."

Specifically, each transportation plan:

> "...shall (1) consider all modes of transportation including mass transit, air, water, pipeline, rail, highway, bicycle and pedestrian; (2) be based upon an inventory of local, regional and state transportation needs; (3) consider the differences in social consequences that would result from utilizing differing combinations of transportation modes; (4) avoid principal reliance upon any one mode of transportation; (5) minimize adverse social, economic and environmental impacts and costs; (6) conserve energy; (7) meet the needs of the transportation disadvantaged by improving transportation services; (8) facilitate the flow of goods and services so as to strengthen the local and regional economy; and (9) conform with local and regional comprehensive land use plans."

The Deschutes County Comprehensive Plan was prepared in 1979 and codified in April 1993. The Plan included a chapter on transportation, which addressed County-wide issues in Deschutes County Code (DCC) 23.60. The County adopted its first TSP in 1998. The TSP was codified in the Comprehensive Plan at DCC 23.64. While the two chapters complement each other, they also introduce a slight bit of confusion and redundancy, so one result of the TSP Update was to just have one chapter in DCC for transportation.

Transportation Planning Rule (TPR)

In April, 1991, the Land Conservation and Development Commission (LCDC) adopted a new administrative rule, the Transportation Planning Rule (OAR 660, Division 12), governing transportation planning and project development at local, regional and statewide levels. The rule was modified in 2004 and 2006, but its overall intent remains unchanged.

Under the Transportation Planning Rule (TPR), Deschutes County must identify a system of transportation facilities and services adequate to meet regional transportation needs outside of the Bend, Redmond, Sisters, and La Pine Urban Growth Boundaries (UGBs). Local and state TSPs must be consistent with one another. Local governments prepare and adopt city and county TSPs which are then submitted to the Department of Land Conservation and Development (DLCD) for acknowledgement by the state.

The Deschutes County TSP has been prepared in coordination with the TSPs for Bend, Redmond, and Sisters. La Pine is the State's newest city and as of 2010 had not yet prepared a TSP. La Pine instead has relied on the Deschutes County TSP, as prior to the City's 2006 incorporation, Deschutes County had planning authority for the area.

Three important aspects of the TPR are that it 1) ties land use to transportation, 2) mandates that transportation planning reduce reliance on any one mode of transportation, and 3) requires a plausible financing program to implement the TSP.

Components of a TSP Required by the TPR

A transportation system plan (TSP) is defined as:

> "...a plan for one or more transportation facilities that are planned, developed, operated and maintained in a coordinated manner to supply continuity of movements between modes, and within and between geographic and jurisdictional areas."

The TSP represents the "first phase" of transportation planning. The TSP establishes land use controls, through the establishment of goals and policies, and provides a map of a network of facilities and services to meet overall transportation needs. The "second phase" is transportation project development, during which the local government determines the exact location, alignment, and preliminary design of improvements identified in the TSP (OAR 660-12-010(1).

The TSP must take into account the State's coordinated population forecast, land use zoning and comprehensive plan designations, trends in traffic volumes and modal choices and/or opportunities, and financial assumptions to arrive at a 20-year transportation plan.

Multi-Modal Planning

The Transportation Planning Rule (TPR) emphasizes the adoption of multi-modal TSPs rather than relying solely on expanding the capacity of the road network. The state, through the TPR, emphasizes the goal of having transportation choices, including walking, bicycling, and transit, rather than an over reliance on the automobile. The challenge is how to be consistent with that intent when planning for the rural areas outside the cities. The TPR also seeks to ensure the safe, efficient, and economic flow of freight and other goods and services via road, air, rail, and marine transportation. There is not any maritime shipping in the High Desert, but the other three are important.

The TPR emphasizes multi-modal improvements in urban areas. However, goals and policies that support multi-modal solutions can be applied to the rural areas of the County and the larger unincorporated communities such as Sunriver, Terrebonne and Tumalo, particularly those that relate to bicycles, sidewalks, transit, or park and ride services.

TSP As A Land Use Decision

According to OAR 660-012-0025(1), adoption of the TSP is a land use decision:

> "...regarding the need for transportation facilities, services and major improvements and their function, mode and general location."

The local adoption of a TSP is governed by DCC Title 22, Deschutes County Development Procedures Ordinance. The final decision by the Board of County Commissioners is subject to review by the Land Conservation and Development Commission (LCDC) and appeal to the State Land Use Board of Appeals (LUBA).

TPR Requirements for Deschutes County

The TPR applies differently to cities, counties, metropolitan planning organizations (MPOs) and the Oregon Department of Transportation (ODOT). There are slivers of land in Deschutes County that are also within the Bend MPO.

The Bend MPO boundaries include the area within the City of Bend UGB as well as areas that may be annexed into the UGB to accommodate growth and anticipated development in the next twenty years. The areas included in the Bend MPO that lie outside of the UGB can be generally described as Deschutes River Woods and the Woodside Ranch area to the south; an area east of the UGB from Stevens Road to US 20; an area east of the UGB from Neff Road to Butler Market Road; the Bend Pine nursery area; an area located northeast of the UGB (Juniper Ridge area); and an area along US 97 north of the Bend UGB.

Of the roughly 88,000 people within the Bend MPO, approximately, 8,000 people live outside of the Bend UGB but within the Bend MPO. Of those 8,000, around 5,000 are within the Deschutes River Woods subdivision between the Deschutes River and US 97.

In terms of land area, the Bend MPO Boundary encompasses 47.08 square miles of which 33.27 square miles are within the Bend UGB and 13.8 square miles are outside the Bend UGB but within the Bend MPO.

The TSP was prepared in coordination with both the City of Bend TSP and the Bend MPO regional transportation plan. This was done to ensure consistency with road classifications, facilities management, and transportation policies. A Deschutes County Commissioner is a member of the Bend MPO Policy Board, and one of the Deschutes County planning staff is a member of the Bend MPO technical advisory committee (TAC). The Bend MPO manager was also a member of the Deschutes County TSP TAC. Thus the Deschutes County TSP complies with the coordination requirements for federally mandated plans as discussed at OAR 660-012-0016.

The TSP identifies transportation needs. Transportation needs are defined broadly in the TPR as:

> "...estimates of the movement of people and goods consistent with acknowledged comprehensive plans and requirements of this rule. Needs are typically based on projections of future travel demand resulting from a continuation of current trends as modified by policy objectives, including those expressed in Goal 12 and this rule, especially those for avoiding principal reliance on any one mode of transportation" (OAR 660-12-005(32).

Local transportation needs are defined as:

> "…movement of people and goods within communities and portions of counties and the need to provide access to local destinations." (OAR 660-012-0005(33)

Regional transportation needs are defined as:

> "…movement of people and goods between and through communities and accessibility to regional destinations within a metropolitan area, county, or associated group of counties." (OAR-660-012-0005(34)

State transportation needs are defined as:

> "movement of people and goods between and through regions of the state and between the state and other states." (OAR 660-012-0005(35)

Under OAR 660-12-055, cities and counties outside of MPOs (such as Deschutes County) were required to complete TSPs for their planning areas by May 1997. However, individual ODOT Region managers had the ability to grant contract extensions as funding allowed. Deschutes County was granted a contract extension until December 31, 1997. The County adopted its original TSP by Ordinance 98-044 on August 26, 1998. The Update of the TSP was begun in January 2007 and adopted by Ordinance 2012-005.

The TPR requires the following broad plan elements in a TSP:

- A determination of transportation needs
- A road plan for existing and future arterials and collectors
- A bicycle and pedestrian plan
- A public transportation plan
- An air, rail, and water transportation plan
- A list of prioritized projects to meet needs and deficiencies
- Cost estimates
- A transportation financing plan
- Policies and land use regulations to implement the TSP
  (OAR 660-012-0020)

1.3 Major Changes Since the Adoption of the 1998 Plan

Since the 1998 TSP was completed Deschutes County has witnessed a vast array of changes. The significant shifts relate to population growth, rise and plateauing of destination resorts, development of regional public transit, changes in federal and local funding of transportation, and changes to ODOT plans and policies.

Regional Growth and Destination Resorts

When the TSP began in 1995, Deschutes County had a population of 94,100 (40,850 in the unincorporated areas and 53,250 within UGBs). In July 2009 the statewide Coordinated Population Forecast certified the County had a total population of 170,705 (59,075 in the unincorporated areas and 111,630 within UGBs). That is an increase of 81% in the County's total population and a 45% increase in the rural population. The latter takes into account the expansion of the Bend, Redmond, and Sisters UGBs plus the incorporation of La Pine and establishment of its UGB. The State of Oregon uses a coordinated population forecast so cities and counties can agree on the expected population and plan accordingly, including potential expansions of UGB's. In other words, the coordinated population forecast is used for planning purposes. The coordinated population forecast factors in jurisdictional boundaries such as UGBs that are not recognized by the federal Census. The County's coordinated population forecast is built upon trends from previous US Censuses as well as information from local jurisdictions regarding building permits, tax assessor's data, zoning designations, migration rates, Census data, etc.

The economic recession that began in 2006 has drastically slowed development in Deschutes County and the various cities. The traffic volumes have dropped commensurately on state highways and the County roads due to rising unemployment levels and increased fuel prices.

In 1998 Deschutes County had one Goal 8 destination resort, Eagle Crest, and several pre-Goal 8 areas that functioned as destination resorts (Black Butte Ranch, Inn of the Seventh Mountain, Sunriver, and Widgi Creek). By 2010 Central Oregon had the greatest concentration of destination resorts in the state with Deschutes County as the epicenter. Eagle Crest had expanded twice and the County now has five approved Goal 8 destination resorts (Caldera Springs, Eagle Crest, Pronghorn, Tetherow, and Thornburgh (which was approved at the local level but is in now in civil court). There are three more destination resorts just across the line in southwest Crook County, another has been mapped in northern Klamath County, and Jefferson County has mapped sites for two potential destination resorts just north of the County line. The combination of the destination resorts in Crook County and the growth of Prineville, the Crook County seat, have brought increased traffic to the Powell Butte Highway and Alfalfa Market/Neff Road.

The potential number of future destination resorts likely will be small in the next 20 years due to three factors. First, the County is remapping the lands suitable for a destination resort overlay designation with the anticipated result the acreage of mapped lands will decrease substantially from 112,000 acres to an expected 15,000. Second, the industry has changed and the business model of a destination resort with attached golf course has lost its viability. Third, the supply of undeveloped lots in the approved resorts is expected to exceed demand over this planning horizon.

Urban Growth and County Coordination

The urban areas have also grown. Bend has become a Metropolitan Planning Organization (MPO) of which Deschutes County and the Oregon Department of Transportation (ODOT) are partners. Bend completed its TSP in 1998, although portions have been under remand. Bend also has a master plan for Juniper Ridge, a 1,500-acre mixed-use development on the City's northeast side that will impact several County facilities, but especially Deschutes Market Road. A city-wide Bend UGB expansion was done in 2009, in concert with the County, to identify future road rights-of-way and policies regarding roadway expansion. The City's proposal has been remanded by LCDC and County and City staff will work together to correct the cited transportation deficiencies. A revised Bend UGB proposal is expected to be completed by 2012.

Redmond completed its TSP in 1997 and updated it in June 2008. In September 2006 ODOT and the City prepared a North Redmond US 97 Interchange Area Management Plan related to the Redmond Re-Route of US 97. In 2005 Redmond worked with Deschutes County to designate Urban Area Reserves to identify where the City would grow in the next 50 years and where transportation facilities would be located or expanded. Deschutes County Ordinance 2006-018 codified those results. The primary aspect from a transportation standpoint was identifying future rights-of-way and crafting policies that roads could be built to the narrower County standards but rights-of-way would be to the larger City standard. (Similar language was included in the Bend UGB expansion.) Setback requirements would ensure development would take place at a distance sufficient so that no buildings or structures would be constructed within roadway expansion areas. Redmond has also updated its TSP to show a "ring road" around the west side of the community using Helmholtz Road, which straddles the City/County border, to go from the north end of town to the south, connecting to a future Quarry Road interchange. The Quarry Road interchange was on the 1998 Deschutes County TSP but the link to Helmholtz was not.

Sisters completed its TSP in June 2001 and updated it in January 2010. The City and County expect to coordinate on an Urban Reserve study in fall 2011. There is policy language in the Sisters TSP deferring to the County on extending Barclay Road east of the City and then south to OR 126 to allow traffic to skirt the US 20/Locust intersection. Based on projected traffic volumes and reserve capacity in the City of Sisters as well as the zoning of the affected properties, the County did not pursue a Barclay Extension in this TSP update.

La Pine, which was previously an Urban Unincorporated Community, voted to become an incorporated City in November 2006. The County assisted the City of La Pine in 2010 with the development of the City's first comprehensive plan, which has been adopted by the City but not yet fully acknowledged by the State. The City expects to begin a TSP soon.

Public Transportation

Public transportation has seen major changes since 1998. Bend has established a fixed-route bus system called Bend Area Transit (BAT), the first such system in the tri-county area. Begun in September 2006, BAT carried its one-millionth rider within three years. Meanwhile, the Central Oregon Intergovernmental Council (COIC), which oversees the transportation component of many social service programs in the tri-county area, began Cascades East Transit (CET). In April 2008, CET offered van shuttle service to and from the major cities in the tri-county area. In 2010 BAT and CET began discussions to have CET manage BAT to relieve the financial pressures of the City of Bend general fund related to BAT. The development of a nascent regionwide transit system has been one of the most critical developments in the tri-county area since 1998.

Commute Options manages the park and ride lots. The increase in park and ride system, both new lots and expansion of existing ones, complements the CET network. While there have been gains in public transit, the private automobile remains the dominant mode in Deschutes County.

Financial Impacts

In 1998, timber payments were still a pillar of County funding, leaving Deschutes County hard hit by the subsequent loss of replacement federal funding meant to offset the loss of timber revenue due to federal restrictions on logging. The Road Department received approximately $3.0 million annually under the Secure Rural School and Community Self-Determination Act of 2000. The program provided bridge funding at a declining rate to soften the loss of timber revenues, but is due to end.

As a result, the Board of County Commissioners (BOCC) passed Resolution 2006-049 which stated the County would no longer accept new roads into the system of County-maintained roads. The moratorium lasts until replacement funding, in the BOCCs opinion, has been restored to adequate levels as timber revenues and their replacement constituted approximately a third of the Road Department's budget. Resolution 2009-118 modified the road moratorium to give the Board the discretion to add new arterials or collectors to the County-maintained system.

One approach the County has used to address the funding shortfall was the development of transportation system development charges (SDCs). The County passed a limited SDC in 2006 for four future signals in South County (Burgess/Huntington; 1st/Huntington; 1st/97; and Finley Butte/97). The SDC, Resolution 2006-010, only applied to lands from La Pine State Recreation Road south. The 1st/Huntington signal was completed in 2006 and the Burgess/Huntington signal was done in 2008. With the incorporation of La Pine in November 2006, the County no longer collected SDCs from lands lying within Oregon's newest city.

The County in July 2008 adopted a County-wide SDC with Resolution 2008-059. The SDC applies to all lands outside of the Bend, Redmond, Sisters, and La Pine UGBs. Fees are collected no later than the issuance of certificate of occupancy. The BOCC set a phased approach, beginning at 85% of the full SDC and increasing it by 5% every July 1 until the full amount began to be collected after June 30, 2011.

State Transportation Changes

The 1998 TSP was done to be consistent with the 1991 Oregon Highway Plan (OHP), the modal plan ODOT uses to manage its highway system. One of the most dramatic changes was the wholesale revisions made to the OHP in 1999. The 1999 OHP altered ODOT's performance standards, modified the functional classification scheme, added several overlay classifications, and incorporated changes to the OARs dealing with access management.

ODOT changed from a delay-based Level of Service (LOS) performance standard, which the County still uses for its roads and intersections, to Volume/Capacity (V/C) Ratios. ODOT's level of importance (LOI) functional classification system has been refined to include classification for specific segments by mile point instead of a single designation for a route's entire length. The OHP has added segment overlays such as Expressway, Freight Route, and Special Transportation Area (STA).

ODOT also changed its rules regarding access management approach. ODOT's previous access management policy under OAR Chapter 734, Division 50 was arranged by the 1991 OHP Category 1 through 4 classifications for highways. Since then ODOT has overhauled its access management policies and implements them through OAR Chapter 734, Division 51 and the 1999 OHP. Access management now depends on functional classification, posted speed, and overlay designations.

The 2000 Oregon Aviation System Plan (OASP) referenced in the 1998 TSP was redone in 2007 and renamed the Oregon Aviation Plan (OAP). Deschutes County incorporated many of the goals of the OASP in its development code in DCC Title 18 to ensure airport-land use compatibility, imaginary surfaces, and height restrictions. The 2007 OAP at Table 1.1 would indicate the County is consistent with the State's aviation plan.

The 1995 Oregon Bicycle and Pedestrian Plan used in the 1998 TSP was revised in 2008. The County has worked with the Deschutes County Bicycle and Pedestrian Advisory Committee (BPAC) and U.S. Senator Ron Wyden (D-Ore.) and Deschutes County Commissioner Tammy Baney on the recommendations from their Central Oregon Recreation Assets Committee, and the related Three Sisters Scenic Bikeway proposal. As a result, the County will for the first time designate bike routes on selected arterials and collectors.

1.4 Updating the Transportation System Plan

Under the Transportation Planning Rule, Deschutes County must identify a system of transportation facilities and services adequate to meet the regional needs and then prepare a transportation system plan which is consistent with the Oregon Transportation Plan (State TSP) and other local TSPs (Bend, Redmond and Sisters). The OTP contains specific criteria and guidelines for local and regional jurisdictions, which form the basis for determining consistency with the state plan.

Performing the analyses and preparing the plan elements described in the guidelines enable Deschutes County and other communities to develop an efficient transportation system, comply with the Transportation Planning Rule, and achieve consistency with other planning jurisdictions including ODOT. Several key performance standards can be used as indicators to determine the adequacy of a transportation system plan. The following elements are addressed by the Deschutes County TSP in order to achieve an adequate plan for the region and satisfy the requirements of the TPR:

- Public and Interagency Involvement
- Plan Consistency
- Consistency with State and Local Plans
- Reduced Auto Reliance
- Network of Streets

Transportation Accessibility

- Efficient Transportation Management
- Safe and Convenient Walking and Bicycling
- Minimize Adverse Economic, Social, Environmental, and Energy Consequences
- Intermodal Linkage and Passenger Services Coordination
- Minimizing Conflicts Between Modes
- Fundable Plan

- Enabling Ordinances
- Facility/Corridor Protection Ordinances
- Development Ordinances to Encourage Alternate Mode Usage

The plan is broken down into the following specific tasks to be completed in a predetermined order.

Review of Existing Plans, Policies, and Standards

Chapter 2 provides a review and evaluation of all current plans and policies affecting Deschutes County, an inventory of the existing transportation system, and deficient transportation facilities in the County. As a part of the review process, initial meetings were held with ODOT, planning and public works staff from the County's four cities and lone MPO, the Deschutes County Bike and Pedestrian committee, and open houses with the general public. Staff also held work sessions with the Deschutes County Planning Commission, Board of County Commissioners, and County Road Department staff. These meetings produced a set of goals and objectives for the Transportation System Plan.

The review involved the following six-step process:

1) Review and evaluation of the existing comprehensive land use and transportation plans.
2) Review of local and state plans.
3) Analysis of existing land uses and vacant lands.
4) Review of existing ordinances, as well as zoning, subdivision, and engineering standards.
5) Review of existing, significant transportation studies.
6) Review of existing capital improvement programs and/or public facilities plans.

Inventory of Existing Transportation Systems
A significant part of developing a transportation system plan is to inventory the existing physical facilities, services and conditions of the transportation system (streets, bikeways, etc.). This task seeks to determine the extent, nature and condition of the facilities and systems already in place to determine how the current system functions.

Inventory of Natural and Cultural Constraints
Although a detailed inventory is not required for this level of strategic planning, any environmental features associated with the existing and planned transportation facilities need to be identified. Examples of environmental features are wetlands, significant natural areas, historic buildings, cemeteries, parks, schools and scenic areas.

Population and Employment Forecasts

Chapter 3 provides a transportation forecast in order to determine the future transportation needs in the County. The County inventoried existing land uses, as well as demographic and economic data outside of the Bend, Redmond, and Sisters Urban Growth Boundaries. Population, employment and traffic forecasts were made based on historic and existing data. In addition to trending historical growth patterns, existing and planned land uses were examined to predict future development growth and to forecast the traffic generated from that development. These forecasts help one to understand the existing transportation system and form the basis for projecting future travel needs. The Transportation Planning Rule requires that forecasts address a 20-year period beginning in the year that the TSP was originally planned for adoption in Deschutes County (2010), therefore, the projections were estimated out to the year 2030.

Determine Transportation Needs

Chapter 4 summarizes the transportation needs of the County based on the outcome of the forecasts and inventory analysis and the concerns of a wide range of Deschutes County residents.

Other Roadway Needs

Several additional needs of the transportation system are not specified in the TPR but they need to be included because they directly affect the transportation-financing plan, which is required by the Rule. The additional needs include:

- Safety needs, including traffic accident data covering at least three years, knowledge of existing unsafe roadway sections or intersections, and a review of any existing traffic safety studies.

- Bridge needs, an inventory of existing bridges and other structures in the transportation system and any needed repairs, widening or replacement.

- Reconstruction needs, based on a prioritized list of existing, substandard roadway sections.

- Operation/Maintenance needs, including the ongoing needs of patching, chip sealing, sweeping, etc., for the continued safe operation of public roadways.

Public Transportation Needs

This requirement addresses two separate needs, one being the mobility needs of the public and the other being the system design considerations (level of service). In general mobility needs fall into two categories: accessibility to jobs in urban areas and the mobility needs in rural areas. Primarily, Deschutes County has rural mobility needs since most of the areas outside the urban growth boundaries fall into the rural category. The TSP requires the determination of demand for public transportation and then the appropriate system design to satisfy that demand.

Bikeway Needs

The bicycle element of the plan addresses the County-wide needs for bicycle transportation and draws upon the existing Deschutes County Master Bikeway Plan (March 1992) and the 1998 TSP for recommendations for new and upgraded facilities. Additional recommendations are provided based upon community input and changes in land use and the street network as well as the proposed Three Sisters Scenic Bikeway network.

Pedestrian Needs

The need for sidewalks is limited outside of UGBs and the business districts of the larger unincorporated communities. In most cases the pedestrian volumes and width of the paved or graded shoulders are such that pedestrians can effectively travel without sidewalks. While the County developed a plan for US 97 in La Pine in approximately 2006, it is incumbent upon the City of La Pine to create a TSP within its boundaries to address pedestrian needs and connections

Transportation System Plan

Chapter 5 outlines the transportation system plan with recommended goals and policies, as well as a list of proposed transportation projects. The project list is prioritized based on various criteria including safety, costs and need.

Financing Plan

Chapter 6 addresses various financing options, provides context of past funding levels, and has scenarios based on a range of expected funding over the next 20 years.

CHAPTER TWO

Inventory and Background

The information for the inventory and background came from a variety of published sources, including ODOT and Deschutes County Road Department data bases and documents; US Census data for the American Community Survey for workplace and commuting; and technical reports from ODOT's Transportation Planning and Analysis Unit (TPAU).

2.1 Existing Transportation Goals and Objectives

The Oregon planning system provides a clear hierarchy with regard to the role of statewide comprehensive planning and its relationship to regional and local planning. The state directs which issues need to be addressed in local plans and how possible problem-solving solutions can be developed.

In Deschutes County the 1998 Transportation System Plan (TSP), previous modal plans, the Terrebonne and Tumalo community plans, and the comprehensive plan policies for Deschutes Junction have all provided guidance on this 2011 update of the TSP. Other critical documents were the Deschutes County Comprehensive Plan, the Oregon Transportation Plan (OTP), and the Oregon Highway Plan (OHP). The OTP includes specific action items as a means of attaining the statewide transportation goals. The existing goals and objectives from these plans are outlined below. In addition, the TSPs for Bend, Redmond, and Sisters were also reviewed.

Deschutes County Comprehensive Plan

The current Comprehensive Plan for Deschutes County was the second Comprehensive Plan developed in the County. After a major planning effort involving many citizens and agency personnel, the plan was adopted in 1979, and then later codified in 1993 as Chapter 23.60 (Transportation) in the Deschutes County Code. County staff began updating the Comprehensive Plan in mid-2008 proposing substantive policy revisions. The revised Comprehensive Plan is expected to be adopted in July 2011.

The 1998 TSP was adopted into the Comprehensive Plan as Chapter 23.64 (Transportation System Plan). As part of the TSP Update process, Chapter 23.60 will be deleted and Chapter 23.64 will be replaced with the current update.

Staff recognized the potential confusion to the public of having both a comprehensive plan update and a TSP Update occurring simultaneously and people wanting to know which document to comment upon. Therefore staff decided to defer all the transportation topics to the TSP Update with the exception of community plans for the unincorporated communities of Terrebonne and Tumalo and comprehensive policy language for Deschutes Junction.

Yet, the goals and objectives set forth in the 1979 comp plan and used in the 1998 TSP remain relevant. The following are the existing County transportation goals:

- To provide a balanced, safe, efficient and integrated transportation system that reflects environmental, economic and social considerations.

- To serve the existing, proposed and future land uses with an efficient, safe, attractive roadway network.

- To provide expansion of opportunities for rail and air transportation for passengers and freight.

- To provide opportunity for the development of public transit systems.

- To provide a system for safe and efficient transportation and recreation routes for pedestrians, bicyclists, and equestrians.

- To decrease the adverse effects of the automobile domination of existing transportation systems.

Deschutes County Major Roads Capital Improvement Plan (MRCIP)

The current draft Deschutes County Major Roads Capital Improvement Program (MRCIP) (Table 2.1.T1) was adopted by the County Board of Commissioners in 2006. This document lists all of the modernization, operations, and safety improvements that the Road Department anticipates completing. The Road Department, in consultation with the Planning Division, updates the MRCIP every three to four years and presents the list to the Board of County Commissioners (BOCC) for adoption by resolution following public hearings.

Deschutes County Pavement Management

Deschutes County is divided up into five road maintenance areas (North, West, Central, South and East). The pavement management system addresses ongoing maintenance of County roads generally related to sealing, widening, overlay and deferred pavement maintenance and preservation activities. Road conditions are routinely monitored by road crews and graded based on condition and need.

Deschutes County Bicycle Master Plan

Previous to the 1998 TSP, the Planning Division relied upon the Deschutes County Bicycle Master Plan which was adopted in March 1992 in the Resource Element of the Deschutes County Year 2000 Comprehensive Plan. The emphasis of the Bicycle Master Plan was to develop an overall network of bikeways to connect the urban areas, recreation areas and destination resorts. The Plan provided goals and objectives, policy recommendations, classifications of bicycle facilities, location of bicycle facilities, bicycle parking and other transportation issues related to bike facilities. Many of the policies identified in the Plan have since been implemented through adopted County ordinances. The bike parking in particular is handled in DCC Chapter 18.116 Supplemental Provisions at DCC 18.116.031, Bicycle Parking, and DCC 18.116.035, Bicycle Commuter Facilities.

DCC Chapter 18.116 was modified in 2010 to give the County the discretion to not require bicycle parking for land use applications that by their rural location or characteristics were unlikely to attract bicycle patronage. The proposed land use would have to be located outside of an unincorporated community, a destination resort, or a rural commercial zone and the proposed use would generate less

than 50 daily trips by all vehicles. Also the size, weight, or dimensions of the goods sold at the site make transporting them by bicycle impractical or unlikely. Examples include a paintball park some 30 miles east of Bend on US 20; a shooting clays range on US 97 between Bend and Redmond; and a golf course.

The 1998 TSP at Section 5.4, Bikeway and Pedestrian Plan, superseded the 1992 Deschutes County Bicycle Master Plan. The TSP's bicycle and pedestrian component in turn was based on Oregon's 1995 Bicycle and Pedestrian Plan. The 1998 TSP defined the County's bike system primarily as a shared shoulder bikeway approach due to low daily traffic volumes (less than 2,500 ADT) on the majority of County roads. The intent was cyclists could use the travel lane on these low-volume roadways, moving to the either the shoulder or the outer edge of the travel lane as the occasional motor vehicle overtook the cyclist.

Additionally, DCC 17.48.140 sets design and construction standards for bicycle facilities at Table B. "Deschutes County Minimum Bikeway Design Standards." Table B differentiates between Multiuse Path, Mountain Bike Trail, Bike Lane, Shoulder Bikeway, and Shared Roadway. The type of bicycle facility relates to functional classification of the parent roadway, anticipated traffic volumes, speed, and urban or rural setting.

Finally, DCC 17.48.140 requires bikeway designs to be in accord with the Oregon Bicycle and Pedestrian Plan, the American Association of State Highway Transportation Officials (AASHTO) "Guide for Development of New Bicycle Facilities," and the Deschutes County Bicycle Master Plan.

Table 2.1.T1

2006-2011 Deschutes County MRCIP Projects

Program Year	Road	Site	Project Type	Project Description	County Road Funds	Other Funds	Total Cost
2006-07	Various	Various	Preservation	Asphalt overlays, widen shoulders for bikes, bring roads up to County standards	$2,200,000	$0	$2,200,000
2006-07	Hunting-ton- 1st St.	La Pine	Intersection improvements	Install traffic signal, turn lanes, and sidewalk	$450,000	$0	$450,000
2006-07	Various	Various	Intersection improvements	Miscellaneous intersection improvements	$20,000	$0	$20,000
2006-07	Millican Rd.	Millican	Trans System Development	Pave George Millican Road from Millican N. to Crook Co. line	$50,000	$0	$50,000
2006-07	Des. Mkt.-Tumalo Rd.	Des. Junction @ US 97	Trans System Development	Complete Phase II to add grade-separated crossing of BNSF tracks	$3,095,000	$0	$3,095,000
2006-07	FS Rd 44/45	Sunriver to Mt. Bchlr.	Trans System Development	Repave, flatten curves, add wider shoulders	$296,494 (County paid $1,00,000 in FY 2005-06)	$10,719,203 from FHWA	$11,015,697
2006-07	Various	Various	Trans System Development	Miscellaneous right-of-way acquisition	$60,000	$0	$60,000
2006-07	Various	Various	Trans System Development	Local Road Improvement Districts (LIDs) approved prior to moratorium	$750,000	$0	$750,000
2006-07	Various	Various	Trans System Development	Bicycle/Pedestrian improvements to comply with 1% of allocated highway funds requirement	$79,000	$0	$79,000
2007-08	Various	Various	Preservation	Asphalt overlays, widen bike shoulders, bring roads up to County standards	$600,000	$0	$600,000
2007-08	Various	Various	Intersection improvements	Miscellaneous intersection improvements	$20,000	$0	$20,000
2007-08	Burgess Rd.	Burgess - Day Rd.	Intersection improvements	Add westbound left turn lane; add eastbound right turn lane	$120,000	$0	$120,000
2007-08	Millican Rd.	Millican	Trans System Development	Pave George Millican Road from Millican north to Crook Co. line	$50,000	$0	$50,000

Program Year	Road	Site	Project Type	Project Description	County Road Funds	Other Funds	Total Cost
2007-08	Des. Mkt.-Tumalo Rd.	Des. Jct. @ US 97	Trans System Development	Complete Phase II to add grade-separated crossing of BNSF tracks	$3,249,750	$0	$3,249,750
2007-08	Various	Various	Trans System Development	Miscellaneous right-of-way acquisition	$20,000	$0	$20,000
2007-08	Various	Various	Trans System Development	Local Road Improvement Districts (LIDs) approved prior to moratorium	$500,000	$0	$500,000
2007-08	Various	Various	Trans System Development	Bicycle/pedestrian improvements to comply with 1% of allocated highway funds requirement	$81,000	$0	$81,000
2008-09	Various	Various	Preservation	Asphalt overlays, widen bike shoulders, bring roads up to County standards	$600,000	$0	$600,000
2008-09	Millican Rd.	Millican	Trans System Development	Pave George Millican Road from Millican N. to Crook Co. line	$50,000	$0	$50,000
2008-09	Various	Various	Trans System Development	Bicycle/pedestrian improvements to comply with 1% of allocated highway funds requirement	$82,000	$0	$82,000
2009-10	Various	Various	Preservation	Asphalt overlays, widen bike shoulders, bring roads up to County standards	$400,000	$0	$400,000
2009-10	Millican Rd.	Millican	Trans System Development	Pave George Millican Road from Millican N. to Crook Co. line	$50,000	$0	$50,000
2009-10	Various	Various	Trans System Development	Bicycle/Pedestrian improvements to comply with 1% of allocated highway funds requirement	$83,000	$0	$83,000
2010-11	Millican Rd.	Millican	Trans System Development	Pave George Millican Road from Millican N. to Crook Co. line	$50,000	$0	$50,000
2010-11	Various	Various	Trans System Development	Bicycle/pedestrian improvements to comply with 1% of allocated highway funds requirement	$84,000	$0	$84,000
Total					$13,040,244	$10,719,203	$23,759,447

Source: Deschutes County Road Department

Since the 1998 Plan's adoption, there has been a marked increase in the use of the County road system by recreational and competitive cyclists, although doubtless there are cycling commuters who live close to urban areas and use Country roads, too. Additionally, Visit Bend, the City of Bend's tourism office, has seized upon the economic benefits of bicycling tourism. Recognizing the demand for better accommodations for cyclists on County roads while the Road Department has faced a declining budget has been a delicate balance.

In preparation of the TSP Update, staff worked closely with the Deschutes County Bicycle and Pedestrian Advisory Committee (BPAC), Senator Ron Wyden, D-Ore, and Commissioner Tammy Baney's Committee on Central Oregon Recreation Assets, and the promoters of the Three Sisters Scenic Bikeway in selecting designated cycling routes on the County's arterial and collector system. The results are in Section 5.4, but the intent was to designate routes cyclists are already using rather than directing riders to other routes.

City of Bend, Transportation System Plan

The City of Bend adopted a TSP in 1998, portions of which the Department of Land Conservation and Development (DLCD) acknowledged and portions of which it remanded, which means the state has required Bend to redo selected components of its TSP. In 2009, Bend adopted an expanded Urban Growth Boundary (UGB) the City's first major expansion in roughly 25 years, which Deschutes County also adopted in Ordinances 2009-001 and 2009-002. The County ordinances do not take effect until the Land Conservation and Development Commission (LCDC) acknowledges the Bend UGB expansion. LCDC remanded the proposed Bend UGB expansion in 2010.

The City and County staff coordinated on policies regarding roadway expansion, functional classification, and generalized location of future roads. These were shown as Exhibit D to Ordinance 2009-001.

The functional classification changes, which do not take effect until the State acknowledges the Bend UGB expansion, were:

- Deschutes Market Road from Rural Collector to Rural Arterial
  - Hamehook from Rural Collector to Rural Arterial
  - Hamby from Rural Collector to Rural Arterial
  - Ward from Rural Collector to Rural Arterial
  - O.B. Riley from proposed Cooley Extension to UGB, from Rural Collector to Rural Arterial
  - Future unnamed Rural Collector from Johnson Road north to a proposed Cooley Extension be reclassified as a Rural Arterial

Policy language in the Bend TSP states roadway facilities within the unincorporated area shall be constructed to Deschutes County standards but shall comply with City of Bend *right-of-way* requirements to allow for the completion to future urban improvement standards when the area is annexed into the City. However, roadway improvements to urban standards shall be permitted in the following situations:

1. When a roadway improvement project is being constructed by the City;
2. When in a land use decision, the required transportation system impact mitigation meets the Dolan/Nolan legal test;
3. A developer voluntarily builds the roadway improvements to urban standards; or
4. The developing property is either master planned or is being simultaneously and expeditiously annexed into the City.

Transportation facilities, that are illustrated on the Bend TSPs Roadway System Plan map, but are located beyond the Bend UGB and therefore not authorized by the TSP, shall not be constructed to an urban standard until approved by the County and the area is brought into the UGB.

As areas are annexed into the City of Bend, or are urbanized within the UGB, the affected land use authority, property owners, developers and/or applicable service districts shall work cooperatively to develop appropriate plans for extensions and connections of the transportation system, including but not limited to: roads, sidewalks, trails and/or public transportation.

City of Bend Municipal Airport Master Plan

The Bend Municipal Airport is located outside the Bend City limits and UGB, therefore the County has land use jurisdiction over it. In order to guide airport land uses, the County adopted and utilizes the 1994 Bend Municipal Airport Master Plan, as amended in 2002 the "Supplement to 1994 Airport Master Plan," which is incorporated by reference herein. This is the guiding document for airport planning and development. This document incorporates a range of facility improvements for the Bend Municipal Airport over the 20-year planning horizon (2021), including short, intermediate, and long-term projects to improve safety and function at the airport. In 2003 the County adopted DCC 18.76, Airport Development (AD) Zone to identify outright permitted and conditional activities at the airport. The County in 2001 adopted DCC Chapter 18.80, Airport Safety Combing Zone (AS) to ensure surrounding land uses and structures were compatible with airport operations.

The City of Bend is currently in the midst of updating of the Bend Airport Master Plan in 2010-12. County planning staff is participating in that process which will look at land uses within the airport as well as the potential for physical expansion of the airport.

City of Redmond Transportation System Plan

The City of Redmond identified the following goals in its Transportation System Plan update of June 2008:

1 Provide a supportive transportation network to the land use plan that provides opportunities for transportation choices and the use of alternative modes serving all residential areas and businesses.

2 Develop a transportation system that is supportive with (sic) the City's adopted comprehensive land plan and with the adopted plans of state, local, and regional jurisdictions.

3 Establish a clear and objective set of transportation facility design and development regulations and standards that address all elements of the city transportation system and promote access to and utilization of a multi-modal transportation system.

4 Develop complementary infrastructure for bicycle and pedestrian facilities to provide a diverse range of transportation choices for City residents.

5 Provide reliable and convenient transit service to Redmond residents and businesses as well as special transit operations for the City's elderly and disabled residents.

6 Ensure that efficient and effective freight transportation infrastructure is developed and maintained to support local and regional economic expansion and diversification consistent with City economic plans and policies.

7 The Redmond transportation network will be managed in a manner that ensures the plan is implemented in a timely fashion and is kept up to date with respect to local and regional priorities.

Policies explicit to Deschutes County include Goal 2, Policy 3, which states the Redmond TSP shall support the City's adopted land use plan and "with the transportation system plans and policies of Deschutes County." Goal 2, Policy 5 call for the City and County and other entities as applicable to work together to "implement regional transportation demand management programs where appropriate." Goal 2 has several strategies for cooperating with Deschutes County on urban service boundaries and road maintenance jurisdiction, corridor management plans for US 97 and OR 126, and coordinated planning with ODOT and the County.

Goal 3, Policy 8 calls for access management to be consistent with ODOT and Deschutes County guidelines. Goal 4, Policy 6 requires coordination with Deschutes County on developing multi-purpose trail systems as does Strategy 2. Goal 6, Policy 6 requires cooperation with Deschutes County and economic development agencies for an intermodal depot that serves freight movement and transfer between modes. Finally, Goal 7, Strategy 6 seeks intergovernmental agreements that would include Deschutes County to coordinate transportation investments and regulation.

Figure 9-1 shows functional classifications for roadways within the City of Redmond UGB and proposes future roads outside the UGB, recognizing such roads will need to be added to the Deschutes County TSP. These include:

- A new east-west arterial from Pershall Way to Northwest Way
- Extending NW Maple Avenue, an arterial, west to NW Helmholtz
- Extending Northwest Way, an arterial, south to NW Hemlock Avenue
- Extending Quartz Avenue, a major collector, west to SW Helmholtz Avenue
- Extending Elkhorn Avenue, a major collector, east to and across US 97 to the fairgrounds
- Extending SW Helmholtz, an arterial, south and east to Quarry Avenue and a future interchange with US 97
- Extending the US 97 Re-Route, a major arterial, south of OR 126 to Quarry Avenue and a future interchange as Phase II, Alternative 3B

Figures 6-1, Pedestrian Master Plan, and 7-1, Bicycle Master Plan utilize the existing and proposed roads shown in Figure 9-1. There are bicycle and pedestrian facilities shown that are outside the current Redmond UGB. These aspirational additional bicycle and pedestrian facilities are discussed further in the Bicycle and Pedestrian portion of this Plan.

Finally, Deschutes County and City of Redmond in 2004-05 collaborated on establishing an Urban Reserve Area (URA) for Redmond, which are the first-priority lands for any subsequent expansion of the Redmond UGB. The County adopted Ordinance 2005-023 and a grid system of future arterials and collectors were mapped in Exhibit C. Road policies in the Redmond URA require new buildings and structures to be constructed at least 90 feet from the existing centerline to allow roads to be widened from County to City standards without displacing residences, buildings, or outbuildings unless meeting the setback requirements is not feasible.

Redmond Municipal Airport (Roberts Field) Master Plan

Roberts Field is the County's only Category 1, Commercial Service Airport. The 1998 master plan was updated in 2011. The proposed 1,500-foot extension of Runway 22 to the northeast will require OR126 be relocated out of the revised Runway Protection Zone (RPZ). The County recognizes the existing Plan as the guiding document for airport-related development and land use in the airport environs. DCC Chapter 18.80, Airport Safety ensures surrounding land uses are compatible with the airport's continued operations and DCC 18.80.030 deals specifically with the Redmond Airport.

City of Sisters Transportation System Plan

The City of Sisters completed its TSP in 2001 and updated the plan in January 2010. The City has an overall transportation goal to provide and encourage a safe, convenient and economic (sic) transportation system. The City has four goals:

1. Comply with the Transportation Planning Rule.

2. Preserve the function, capacity, level of service, and safety of the state highways (US 20, OR 126, and OR 242).

3. Improve and enhance safety and traffic circulation and preserve the level of service on the street system.

4. Increase the use of alternative modes of transportation (walking, bicycling, rideshare/carpooling, flexible work hours, telecommuting, and transit) through improved access, safety, and service.

Within the four goals are several objectives, of which only two are explicit to Deschutes County. Goal 3, Objective E is to "ensure planning coordination between the City of Sisters, Deschutes County, and the State of Oregon." Goal 4, Objective G is to "plan for future transit service by seeking City, County, State, and/or Federal support."

There were no changes to functional classifications for roads that link Deschutes County and the City of Sisters, nor were any new roadways proposed outside the Sisters UGB.

The Sisters TSP does reference on Page 7-26 discussions between Deschutes County and ODOT about exploring the potential to extend Barclay Road east of Locust Street as a County roadway to provide a new connection to OR 126. The intent of a Barclay Extension to OR 126 would be to provide a parallel local route to provide relief to the US 20/Locust intersection. However, as US 20/Locust meets the ODOT mobility standards in 2030 and given the land use designation of the affected properties and opposition from the affected property owners, the County has decided not to pursue a Barclay Extension in this update of the County TSP. However, the City of Sisters, ODOT, and Deschutes County will continue to monitor the performance of the US 20/Locust intersection and review the need for a Barclay Extension to OR 126 as conditions warrant.

Oregon Transportation Plan

The Oregon Transportation Plan (OTP) is the State's long-range, multi-modal plan. Originally adopted by the Oregon Transportation Commission (OTC) in 1992 and most recently updated in September 2006, the OTP is the overarching policy document among a series of plans that together form the state transportation system plan. The OTP considers all modes of Oregon's transportation system as a single system and addresses the future needs of Oregon's airports, bicycle and pedestrian facilities, highways and roadways, pipelines, ports and waterway facilities, public transportation, and railroads through 2030. The OTP is meant to address the challenge that by 2030 Oregon's transportation system needs to accommodate 41 percent more population and an 80 percent increase in freight tonnage. A link to the complete OTP is listed in Appendix A.

The OTP, which is not adopted by local governments, stresses managing existing transportation assets, using technology to maximize the performance of existing systems, and focusing on realistic funding levels. The OTP's goals are:

1. To enhance Oregon's quality of life and economic vitality by providing a balanced, efficient, cost-effective and integrated multimodal transportation system that ensures appropriate access to all areas of the state, the nation and the world, with connectivity among modes and places.

2. To improve the efficiency of the transportation system by optimizing the existing transportation infrastructure capacity with improved operations and management.

3. To promote the expansion and diversification of Oregon's economy through the efficient and effective movement of people, goods, services and information in a safe, energy efficient and environmentally sound manner.

4. To provide a transportation system that meets present needs without compromising the ability of future generations to meet their needs from the joint perspective of environmental, economic and community objectives. This system is consistent with, yet recognizes differences in, local and regional land use and economic development plans. It is efficient and offers choices among transportation modes. It distributes benefits and burdens fairly and is operated, maintained and improved to be sensitive to both the natural and built environments.

5. To plan, build, operate and maintain the transportation system so that it is safe and secure.

6. To create a transportation funding structure that will support a viable transportation system to achieve state and local goals today and in the future.

7. To pursue coordination, communication and cooperation among transportation users, providers and those most affected by transportation activities to align interests, remove barriers and bring innovative solutions so the transportation system functions as one system.

Oregon Highway Plan

As the highest traffic volumes in the County occur on the State highway system, the Oregon Highway Plan (OHP) is the most critical modal plan for the transportation future of the County. The OHP was adopted by the OTC in 1991, updated in 1999, and amended in 2006. The OHP is the highway element of the OTP and analyzes the state highway needs to 2012. The OHP classifies highways by function and special

overlay segments, sets performance standards for segments and intersections, provides management goals, and gives policy and investment direction.

Of all the various State and local plans revised since the 1998 Deschutes County TSP was adopted, the OHP has seen the most changes. ODOT went to a new classification system, enhanced the highway segment designations, revised the access management spacing standards and shifted analytical methods from time-based Level of Service (LOS) to a Volume-Capacity (V/C) ratio. The OHP link is in Appendix A.

In the OHP the Vision Element looks at the future of the state highway system based on demographic and economic forecasts as well as future transportation technology. The Policy Element contains goals, policies, and actions in five areas: system definition, system management, access management, travel alternatives, and environmental and scenic resources. The System Element analyzes state highway needs, forecasts revenues, describes investment policies and strategies, and has an implementation strategy and performance measures.

The major goals of the OHP are as follows:

1. System Definition: To maintain and improve the safe and efficient movement of people and goods and contribute to the health of Oregon's local, regional, and statewide economies and livability of its communities.

2. System Management: To work with local jurisdictions and federal agencies to create an increasingly seamless transportation system with respect to the development, operation, and maintenance of the highway and road system that:

    - Safeguards the state highway system by maintaining functionality and integrity
    - Ensures that local mobility and accessibility needs are met
    - Enhances safety and efficiency

3. Access Management: To employ access management strategies to ensure safe and efficient highways consistent with their determined function, ensure the statewide movement of goods and services, enhance community livability and support planned development patterns while recognizing the needs of motor vehicles, transit, pedestrians and bicyclists.

4. Travel Alternatives: To optimize the overall efficiency and utility of the state highway system through the use of alternative modes and travel demand management strategies.

5. Environmental and Scenic Resources: To protect and enhance the natural and built environment throughout the process of constructing, operating, and maintaining the state highway system.

OHP Functional Classification

The OHP attempts to balance local land use development with the need to move goods and services through Oregon based on the designated Level of Importance (LOI). Generally Interstates and Statewide Highways favor mobility over access; Regional Highways slightly favor mobility over access; and District Highways and Local Interest Roads favor access over mobility. There are also two important overlay designations, Expressways and Freight Routes. Expressways are intended for high-speed and high-volumes and Freight Routes are to be managed to ensure less congestion. On designated Expressways and Freight Routes, the mobility of through traffic is given more emphasis.

ODOT's management objectives by functional class are given in Table 2.1.T2. While these classifications do not correlate to any funding or modernization priorities on ODOT's part, they do play a role in ODOT's response to the local land use process.

The functional classifications and highway segment definitions determine the mobility standard for the State highway and Table 6 in the OHP is applicable to Deschutes County. Other factors include posted speed, inside or outside of an UGB, in unincorporated community or on rural lands, etc. When County roads intersect with State highways, the State's V/C ratio is the controlling performance standard. In locations where it would be infeasible to meet the OHP's V/C ratios, the objective is either to maintain the existing performance of the highway or to propose alternate mobility standards for the approval of the OTC at the affected location(s). The applicable V/C table is Table 6 in the OHP.

OHP Access Management

The functional classifications are also tied the agency's access management spacing standards and management objectives. The spacing standards set the desired distances for physical connections to the highway for both private driveways and public rights-of-way. The management objectives concern the consolidation, restriction, or elimination of accesses to the State highway system. In times of restricted funding, access management provides a comparatively low-cost tool to reap substantial benefits in system efficiency and safety. Generally, the higher the functional classification of the highway, the more restrictive the access goals become. Also the OHP at Action 3A.4 discourages traffic signals in rural locations. Both ODOT and Deschutes County would prefer rural roundabouts. Finally, ODOT desires raised non-traversible medians on highway segments that are anticipated to have more than 28,000 vehicles per day during the 20-year planning period, have an annual crash rate higher than the statewide average for similar facilities, or pedestrians are unable to safely cross the highway as indicated by a crash rate greater than the statewide rate for similar facilities. The OHP stresses including non-traversible medians for all new highways with multiple lanes on completely new alignments and modernization of all rural, multi-lane Expressways, including Statewide, Regional and District highways. The access management spacing standards are provided in Appendix D.

Table 2.1.T2

State Highways by Functional Classification

Functional Class	Characteristics	Management Objective	Examples
Interstates	Provide connections to major cities, regions of the state, and other states.	Safe and efficient high-speed, continuous flow operations in urban and rural areas	None in Deschutes County.
Statewide	Provide inter-urban and inter-regional mobility and provide connections to larger urban areas, ports, and major recreation areas not served by interstates. Secondarily, provide intra-urban and intra-regional trips.	Safe and efficient, high-speed, continuous-flow operation. In constrained and urban areas, interruptions to flow should be minimal. Inside Special Transportation Areas (STAs) access may also be a priority	U.S. 97, U.S. 20, OR 126
Regional	Provide connections and links to regional centers, Statewide or Interstate Highways, or economic or activity centers of regional significance	Safe and efficient, high-speed, continuous-flow operation in rural areas and moderate to high-speed operations in urban and urbanizing areas. Secondary function is to serve land uses in the vicinity. In STAs local access is also a priority. Inside Urban Business Areas (UBA), mobility is balanced with access.	OR 31
District	Road of countywide significance and functions largely as county and city street arterials or collectors, providing ties between small urbanized areas, rural centers and urban hubs. Secondarily, they serve local access and traffic.	Safe and efficient moderate to high-speed continuous flow operation in rural areas reflecting the surrounding environment and moderate to low speed operation in urban and urbanizing areas for traffic flow and for pedestrian and bicycle movements. In STAs, local access is a priority; in UBAs mobility is balanced with local access.	OR 242, OR 370 (O'Neil Highway), OR 372 (Cascade Lakes Highway), OR 27 (Crooked River Highway)
Local Interest	Function as local streets or arterials and serve little or no purpose for through traffic or mobility. Some are frontage roads, some are not eligible for federal funding.	Safe and efficient, low to moderate speed traffic flow and for pedestrian and bicycle movements. Local access is a priority in STAs. ODOT will try to transfer these roads to local jurisdictions.	Jamison Road between Empire and Robal.

Source: Oregon Highway Plan, examples from Deschutes County and ODOT Region 4 staff

OHP Major Improvements

As funding levels have decreased the agency has less and less ability to construct expensive modernization projects. ODOT, in cooperation with local jurisdictions, protects and improves the efficiency of the existing system before building new highways or realignments. The following actions in Policy 1G are listed in the order of implementation, with lower numbered actions in Action 1G.1 being done first.

1. Protect the existing system: The highest priority is to preserve the functionality of the existing highway system by means such as access management, local comprehensive plans, transportation demand management, improved traffic operations, and alternative modes of transportation.

2. Improve efficiency and capacity of existing highway facilities: The second priority is to make minor improvements to existing highway facilities such as widening highway shoulders or adding auxiliary lanes, providing better access for alternative modes (e.g. bike lanes, sidewalks, bus shelters), extending or connecting local streets, and making other off-system improvements.

3. Add capacity to the existing system: The third priority is to make major roadway improvements to existing highway facilities such as adding general purpose lanes and making alignment corrections to accommodate legal size vehicles.

4. Add new facilities to the system: The lowest priority is to add new transportation facilities such as a new highway or bypass.

OHP Highway Bypasses

After a case study showed the dynamic role local land use can play in the premature obsolescence of a new highway alignment coupled with the rising costs of road construction in an era of shrinking revenues, the OHP was amended in 2003 to add a Bypass Policy. Bypasses are highways designed to maintain or increase mobility for through traffic. Generally they relocate the highway alignment around a downtown, an urban or metropolitan area or an existing highway to provide an alternative route for through traffic using that highway. Sometimes they also function as principal urban arterials. Bypasses require good system management to protect the significant public investment and achieve mobility and livability goals. Although many urban areas and unincorporated communities in Deschutes County desire a bypass, the following policies must be satisfied.

The objectives of the Bypass Policy are:

1. To maintain and enhance the utility of the state highway investment,

2. To assure land uses that are consistent and compatible with Oregon statewide land use goals,

3. To identify the appropriate function of bypasses in the transportation system, and

4. To guide the long-term operation of bypasses through agreement on land use and transportation management actions.

To attain these objectives, bypasses require local and state policy coordination involving land use, local street patterns, access control, design characteristics, the bypassed facility, and jurisdictional transfer under Oregon Revised Statute (ORS) 366.

Statewide Transportation Improvement Program

The Oregon Statewide Transportation Improvement Program (STIP) is essentially the State's capital improvement program. The STIP is updated every other year and encompasses all federally and state-funded improvements for which funding is approved and are expected to be undertaken during the four-year period. STIP projects are taken from projects listed in adopted TSPs and/or metropolitan regional transportation plans (RTPs). Federal requirements mandate the STIP must be financially constrained, which means funding is identified for projects.

Table 2.1.T3 identifies the STIP projects located in Deschutes County but outside the various cities. If a project straddles a County/city border it is included in the table. This includes projects from the adopted 2008-2011 STIP and the draft 2010-2013 STIP. While most STIP projects are site specific, others occur throughout ODOT's Region 4, which extends from the Columbia River to the California border in Central Oregon. Between the funding crisis at the federal and state level and ODOT retiring debts incurred during the three phases of Oregon Transportation Investment Act (OTIA) of 2001, the State has little to no funds for modernization projects. This is a change in circumstance that is unprecedented in the post-World War II era.

OTIA I(2001) increased driver and motor vehicles fees to pay for $400 million in bonds as interest rates were fairly low. The resulting funds were for modernization projects to increase lane capacity and grade-separated interchanges ($200 million); repair and replace bridges ($130 million); and pavement preservation ($70 million.)

OTIA II (2002) added an additional $100 million bonding to fund lane capacity and grade-separated interchanges ($50 million); repair and replace bridges ($45 million); and pavement preservation ($5 million). Due to cost-sharing with local governments and low interest rates, OTIA I and II resulted in building $672 million in projects for $500 million, according to ODOT.

OTIA III (2003) used a combination of ODOT revenues, federal funds, and bonds to bond for a total of $2.6 billion. The funds are programmed for modernization ($500 million); replacement of state and local bridges ($1.3 billion); and city and county road maintenance ($361 million).

Table 2.1.T3

STIP Projects in Rural Deschutes County, 2008-2015

Program Year	Road	Project	Project Type	Project Description	Cost
2008	OR 126	MP 97 – Rimrock Way	Preservation	Preserve pavement, install flashing beacon at OR 126/Helmholtz, upgrade sidewalks	$7,786,000
2008	Various	Meissner Sno-Parking Lot expansion	Special Programs	Recreational trail project	$106,000
2008	Various	Deschutes Paddle Trail	Special Programs	Develop Deschutes River trail guide and signage for river trail on USFS land	$120,000
2008	US 20 – OR 242	Scenic Byways	Special Programs	Visual enhancements	$69,000
2008	Various	Volcanic Legacy AAR: Out of Region Marketing Project	Scenic Byways	Volcanic Legacy Scenic Byway marketing project	$76,000
2008	Various	Region 4 Transportation Demand Management Program	Operations	Promote and support Transportation Demand Management in Region 4	$85,000
2008	Various	Region 4 Transit Support	Transit Capital	STP transfer to support transit services in Region 4	$149,000
2009	US 20	US 20 @ Tumalo Environmental Assessment	Environmental	Develop design-level environ-mental impact statement (EIS)	$408,000
2009	US 97	US 97: Redmond Re-Route South Extension (EA & IAMP)	Modernization	Conduct environmental and interchange area management plan	$1,000,000
2009	US 97	US 97: Lava Butte – South Century Drive	Modernization	Add travel lanes, close accesses, and build frontage roads	$39,811,000
2009	US 97	US 97: Crooked River Bridge – Redmond Re-Route	Preservation	Preservation, access management, alternative local roads, widen shoulders and safety upgrade	$7,199,000
2009	US 97	US 97: Lava Butte Clearing and Grubbing (Small Business)	Modernization	Clearing and grubbing along roadway	$100,000
2009	US 97	US 97: Railroad Crossing and Relocation Study	Planning	Rail crossing and relocation study for US 97 at Wickiup Jct/Burgess Rd area	$50,000
2009	Various	Huntington Road/Riverview Dr: S. Century – Burgess Rd	Preservation	2-inch pavement overlay	$1,263,000
2009	Various	South Century Dr – General Patch Bridge – Burgess Rd	Preservation	Widen roadway, grade and improve road base, drainage pave USFS Road #42	$10,150,000
2009	Various	Kwohl Butte Shelter	Special Programs	Recreation trail project	$101,000
2009	Various	Kapka Butte Sno-Park	Special Programs	Snow park construction	$520,000
2009	Various	Region 4 material source development	Operations	Develop aggregate materials sources in Central Oregon for STIP projects	$153,000

Program Year	Road	Project	Project Type	Project Description	Cost
2009	Various	Region 4 Transportation Demand Management Program	Operations	Promote and support Transportation Demand Management program in Region 4	$85,000
2009	Various	Region 4 Transit Support	Transit Capital	STP transfer to support transit services in Region 4	$268,000
2010	US 97	US 97: Crooked River – O'Neil Highway Refinement	Planning	Plan for access management and improvements from northern terminus of Redmond Re-Route to Crooked River Bridge	$245,000
2010	US 20	US 20: Purcell-Arnold Ice Cave	Preservation	Pavement preservation with sidewalk improvements	$3,990,000
2010	US 20	US 20: 5th St-O.B. Riley Road (Tumalo)	Operations	Construct low-median barrier on US 20, left turns and highway crossings, widen shoulders	$200,000
2010	Various	Wanoga Mountain Bike Event Area	Special Programs	Bike event area improvements	$95,000
2010	Various	Region 4 Remote Weather Info System Upgrades	Operations	Replace and upgrade aging RWIS in Region 4	$25,000
2010	Various	Lava Butte – Sunriver Multi-use Path	Enhancement	Develop plan for multi-use path	$100,000
2010	Various	Region 4 Transportation Demand Management	Operations	Promote & support transportation demand management programs in Region 4	$106,000
2010	Various	Bend Communications Plan	Operations	Develop communications plan in Central Oregon	$50,000
2010	Various	Regionwide Travel Information System (ITS)	Operations	Remote cameras, message signs and new technology to improve travel info	$87,000
2010	Various	Region 4 Transit Support	Transit Capital	STP transfer to support transit services in Region 4	$268,000
2010	Various	Region 4 Transportation Demand Management	Operations	Promote and support TDM programs such as carpool and vanpool	$107,000
2011	US 97	US 97 Bend North Corridor Project	Modernization	Purchase land as part of corridor development	$5,924,000
2011	Various	Region 4 Transit Support	Transit Capital	STP transfer to support transit services in Region 4	$270,000
2011	Various	Region 4 Transportation Demand Management	Operations	Promote and support TDM programs such as carpool and vanpool	$123,000
2011	Various	Region 4 Modernization/Preservation balancing	Preservation	Region 4 Preservation funds used to balance cost overruns in modernization from 2008-11 STIP	$5,856,000
2012	US 97	Bend North Corridor Project	Modernization	Purchase land as part of corridor development	$3,000,000

Program Year	Road	Project	Project Type	Project Description	Cost
2012	Cascade Lks Hwy	Cascade Lakes Hwy: MP 26.3, Goose Creek	Enhancement	Federal Highway aquatic organism passage project	$292,000
2012	Cascade Lks Hwy	Cascade Lakes Hwy: MP 25.1, Soda Creek	Enhancement	Federal Highway aquatic organism passage project	$292,000
2013	Skyliners Road	Skyline Ranch Road – USFS Road #4603	Enhancement	Reconstruct Skyliners from Bend to end of County maintenance	$11,125,000
2013	Skyliners Road	Trailhead enhancement (Phil's Trail complex)	Enhancement	Trailhead expansion ,paved parking, restrooms, kiosks	$313,000
2014	US 97	US 97: Baker Road VMS	Operations	Install Variable Message Sign for southbound traffic	$550,000
2015	US 97	US 97: Lava Butte median barrier	Safety	Widen median and install raised concrete barrier	$1,040,000
2015	Cascade Lks Hwy	Trailhead enhancement	Enhancement	2 sno-park area expansion with kiosks, shelter, and restrooms	$513,000
				Total**	$42,257,000

Source: ODOT
Note: * No funding has been identified for these projects.
** Excludes unfunded projects.

Oregon Aviation System Plan

The Aviation System Plan identifies a base airport system, system funding needs and gaps, and recommends various strategies to pay for the system. It will also recommend policies to guide the state in protecting, maintaining and developing the airport system. It will provide an inventory and forecasts for airports statewide. Some key issues that affect the Plan include:

- Local governments own most public use airports
- The federal government owns most of the navigational system.
- The Federal Aviation Administration (FAA) determines funding levels and prioritization of expenditures for nationally recognized National Plan of Integrated Airport Systems (NPIAS) airports.
- U.S. Congress proposes to severely limit or eliminate general aviation airport funding altogether.

Oregon Bicycle and Pedestrian Plan

In June 1995, the Oregon Transportation Commission adopted the Oregon Bicycle and Pedestrian Plan. The plan represents a modal element of the Oregon Transportation Plan and serves to guide cities, counties and others in establishing facilities on local transportation systems. The plan focuses on existing street systems in urban areas, where short trips are more realistic and where most congestion problems occur. The plan found that existing statewide conditions are generally good for bicyclists on rural highways, and not very good or poor for bicyclists and pedestrians on many urban highways. Also, local systems with good walking and cycling conditions were highlighted as examples to emulate. The plan acknowledges that ODOT will provide appropriate pedestrian and bicycle facilities to meet the following goal and actions:

Goal: To provide safe, accessible and convenient bicycling and walking facilities and to support and encourage increased levels of bicycling and walking.

Action 1: Provide bikeway and walkway systems that are integrated with other transportation systems.

Action 2 Create a safe, convenient and attractive bicycling and walking environment.

Action 3: Develop education programs that improve bicycle and pedestrian safety.

Each action is refined with specific strategies. After determining needs and priorities, the plan provides for the establishment of bike and walking facilities in the following ways:

- Rural highways will have shoulders widened in the course of modernization projects, as well as on many preservation overlays, where warranted.

Cost to Implement the Plan: The overall cost to retrofit the existing urban highway system with appropriate facilities is estimated at $150 to $200 million. This would require expending $7.5 to $10 million per year to accomplish the goal in 20 years; this doubles the current ODOT expenditures on pedestrian and bicycle facilities.

ODOT updated its Bicycle and Pedestrian Plan in late 2011. In terms of rural highways, there is not much difference between the '95 Bike/Ped plan and the 2011 version. Appendix A contains a link to the revised Bike/Ped Plan.

2.2 Existing Transportation System and Current Needs

Existing Road System

Deschutes County is responsible for maintaining approximately 832 total miles of roads within the County system. Out of the total miles maintained by the County, approximately 632 miles are paved and 139 miles are unpaved. There are 95 miles of non-maintained County roads of which 94 are unpaved. There are an additional approximately 376 miles of unpaved roads dedicated to the public but not in the County-maintained system. In other mostly unpopulated areas, roads totaling approximately 410 miles are under the jurisdiction of the U.S. Forest Service, U.S. Bureau of Land Management, the Oregon State Forestry Division, or the Oregon State Parks Division.

As local jurisdictions have expanded their Urban Growth Boundaries and/or annexations, the County turns over jurisdiction and maintenance to the municipalities. In 2010 Deschutes County had 0 miles of maintained roads within Bend, Redmond, and Sisters, and roughly 21 miles in La Pine. The County continues to work with the City of La Pine on a jurisdictional transfer for roads. Contrast that with the 1998 TSP when the County had 120 miles to maintain in Bend, Redmond, and Sisters (La Pine was unincorporated). Finally, within Deschutes County, ODOT controls approximately 218 miles of the state highway system.

The bulk of the County's paved roads are located west of U.S. 97 and north of U.S. 20 on rural land. The County's arterial and collectors predominantly either parallel or lead to the major state highway corridors. All of the County's paved roads are two lanes with the exception of turn lanes at intersections. There are no passing or climbing lanes anywhere in the County-maintained system of roads. In 2009 the daily traffic volumes on County roads ranged from 40 on Barr Road, an unpaved road between OR 126 and Cline Falls Highway near Tumalo, to 8,404 vehicles on Baker Road near the U.S. 97 interchange on the southern outskirts of Bend near Deschutes River Woods.

The Road Department in its pavement management system maintains base level information such as physical condition, type of surface, type of subgrade, etc. The Road Department on a rotating cycle also collects traffic volume count information. This rotating cycle produces updated peak-hour and daily traffic volume totals once every two to four years for most arterial and collector roads in the County. This existing database provided a starting point for a detailed physical inventory of all County arterials and collectors. The traffic count data for the state highways come from the most recent traffic volume tables published by ODOT. The results of the inventory are used to define existing street and road capacities, define short-term improvement projects and form the basis for long-term transportation alternatives.

Types of Roads in Deschutes County

There are many types of roads in Deschutes County. The following are some definitions and examples of the types of roads commonly found in the County.

Road - means the entire right-of-way of any public or private way that provides ingress to or egress from property by means of vehicles or other means or that provides travel between places by means of vehicles. "Road" includes, but is not limited to:

- Ways described as streets, highways, throughways or alleys;
- Road related structures that are in the right-of-way such as tunnels, culverts or similar structures; and
- Structures that provide for continuity of the right-of-way such as bridges.

Public Road - means a road over which the public has a right of use that is a matter of public record. Maintenance of public roads, including plowing and repair, is the responsibility of the adjoining property owners. There are far more miles of public roads in rural Deschutes County than there are miles of County roads or state highways. While the County does not maintain these roads, the County remains the road authority so, for example, adjoining property owners cannot decide to pave, realign, or place a gate without approval from the County.

County Road - means a public road under the jurisdiction of a county that has been designated as a county road under ORS 368.016. County roads are maintained (paved, repaired, plowed, bladed) by the County. A public road becomes established as a County Road by order of the County Commissioners. Since the decline of federal payment to offset loss of timber revenues, the Board of County Commissioners has placed a moratorium on accepting any new roads into the County-maintained system, with possible exceptions for arterials and collectors. Lower Bridge Way, Powell Butte Highway, and Burgess Road are examples of County roads.

Local Access Road - means a public road that is not a county road, state highway or federal road.

Private Road - Private roads have not been dedicated to the public. These roads do not come under County, City or State jurisdiction. Examples of private roads include those in Sunriver, Eagle Crest and Black Butte Ranch. Roads created by easements between two parties can also be considered private roads.

Easement - An access or road easement occurs when one person allows another person to drive (cross) their property. The property owner granting the easement still owns the land under the easement, but the other party has a legal right to use the easement. The public, except for invited visitors, does not have a right to use the easement.

State Highway - A State Highway is a public road, maintained by the Oregon Department of Transportation.

Miscellaneous Roads - In addition, the U.S. Forest Service and the Bureau of Land Management have roads on their lands in Deschutes County that they maintain and retain jurisdiction. Many improved, gravel surfaced or paved roads were constructed as a condition of approval of a subdivision of land. Other public roads have been improved through the formation of a *Special Road District*. People living within an area may form a special road district to improve and maintain the roads within a specially designated geographical area such as a subdivision. The residents forming the district agree to pay property taxes to support the special district. Road District Commissioners are appointed by the Deschutes County Board of Commissioners to operate the special road district. The special road district improves and maintains the roads within the district to the level agreed to by the residents of the district.

Prior to the July 5, 2006, passage of Resolution 2006-049, County residents could also petition the Deschutes County Board of Commissioners to form a *Local Improvement District* (LID) to get their road improved. This usually involves the paving of a gravel or dirt road. Public roads improved under the LID process may be accepted by the Deschutes County Commissioners as a County-maintained road. Under an LID, property owners agree to pay for road improvements.

The Board in Resolution 2006-049 passed a moratorium on accepting new roads into the County-maintained system, citing the loss of approximately $3 million dollars in annual federal funds as the federal Secure Rural Schools and Community Self-Determination Act of 2000 expired. Also known as the Forest Safety Net, these funds replaced money lost as timber harvesting on federal lands disappeared. The Forest Safety Net funds constituted 27% of the County Road Department's budget. The Board on October 5, 2009, modified the moratorium to consider adding new designated collectors or arterials to the County-maintained system in Resolution 2009-118.

The Board passed Resolution 2009-118 after Oregon approved the first increase in the State's gasoline tax since 1993 and the federal government extended the Forest Safety Net program to 2011. The federal Forest Safety Net funds would comprise 20% of the County Road Department's budget.

Road System Configuration

Functional classification describes how the public road system should operate based on area served, distance of the trips carried, and proximity to roads of both higher and lower classification. Ideally, a local road leads to a collector which in turn flows into an arterial that then intersects with a principal arterial, which is a State highway. While urban roads are often classified primarily by daily traffic volumes, rural roads are not stratified strictly by the vehicles carried. The County has tried to provide a rural-scale grid system of arterials and collectors that recognizes population distribution and recreational amenities.

The road system of state highways, arterials, and collectors should work in conjunction to form a rural network having the following characteristics:

1. Link cities and larger towns (and other traffic generators, such as major resort areas, that are capable of attracting travel over similarly long distances) and form an integrated network providing interstate and intercounty travel.

2. Be spaced at such intervals, consistent with population density, so that all developed areas of the State are within a reasonable distance of an arterial highway.

3. Provide (because of the previous two characteristics) service to corridors with trip lengths and travel density greater than those predominantly served by rural collector or local systems. Minor arterials constitute routes whose design should be expected to provide for relatively high overall travel speeds, with minimum interference to through movement.

Roads are grouped by their similar characteristics in providing mobility and/or land access. Within the County-maintained system, there are four rural road classifications (Rural Local; Rural Collector; Forest Highway; Rural Arterial) and three urban classifications (Urban Local; Urban Collector; Urban Arterial). The State highways are classified in the County system as Principal Arterials. ODOT has its own classification to differentiate State highways and segments of State highways.

Table 2.2.T1 provides a summary of the County-maintained system arranged by mileage and classification. The text immediately following Table 2.2.T1 explains the purpose and traits of the various classifications in broad terms. A link to complete data lists for all County arterials and collectors can be found in Appendix F.

The following represents a general overview of state highways, street functional classifications and a listing of County roads falling under each category. Figure 2.2.F1 identifies the current Deschutes County Road System.

The physical inventory of County roads included the following elements as required by the state Transportation Planning Rule (TPR):

- Road Classification and Jurisdiction
- Right-of-Way Width
- Number of Travel Lanes
- Lane Width
- Inclusion of Sidewalks
- Bike Facility Type (if present)
- Location of Traffic Control Devices/Signals
- General Pavement Condition

Table 2.2.T1

Deschutes County Road Mileage and Maintenance Responsibility by Functional Classification

Deschutes County	Urban Arterial	Urban Collector	Urban Local	Rural Arterial	Rural Collector	Rural Local	Forest Highway	Total Miles
County-Maintained (693 miles paved, 139 miles unpaved)	2	12	17	69	241	399	92	832
County Non-Maintained								95
Public Roads (all unpaved)								376
Subtotal:	**2**	**12**	**17**	**69**	**241**	**399**	**92**	**1,303**

Source: Deschutes County Road Department

Road Functional Classifications

Roads in the County are classified by two major themes: State highways vs. County roads; and rural settings vs. an urban context.

Rural

Principal Arterial (examples are US 97, US 20, OR 126):

- State highways are only facilities included
- Trip length and travel density characteristics are representative of substantial statewide or interstate travel
- Penetrates urban boundaries, or comes within 10 miles of the center of an urban area of 25,000 population or greater, and is within 20 minutes travel time (off-peak) of the center of the area via a minor arterial road
- Movement of interstate goods and services
- Substantial movement of long-haul trucking
- Primary route for movement of goods and services

Arterial (examples are Powell Butte Highway, Cline Falls Highway, Neff-Alfalfa Market Road):

- Links cities, larger towns, and other major traffic generators, providing interregional and intercounty service; and
- Spaced at distances so that all developed areas are within reasonable distance of an arterial highway; and
- Provides service to corridors with trip length and travel density greater than that predominately served by rural collector or local systems
- Serves the more important intra-county travel corridors
- Secondary route for movement of goods and services

Collector (examples are Lower Bridge Way, Indian Ford Road, Tumalo Road, Huntington Road):

- Spaced at intervals to collect traffic from local roads and provide all developed areas a reasonable distance from a collector road; and
- Provides service to the remaining smaller communities; and
- Links locally important traffic generators with rural destinations.

Forest Highways (examples are China Hat Road, Cascade Lakes Highway, River Summit Drive):

- Special class of rural arterial
- Provides access to recreational amenities such as campsites, lakes, hiking and biking trails in Deschutes National Forest or to the USFS road network
- Forest Highways are a mix of County-maintained roads and a few of the major two-digit USFS roads which are maintained by the Forest Service, not the County

Local (examples are Sisemore Road, Arrow Avenue, Ranger Way):

- Primarily provides access to adjacent land/properties; and
- Accommodates travel over short distances as compared to arterials and collectors.

Urban

Principal Arterial (examples are US 97, US 20, OR 126):

- Only State highways are in this classification
- Serves the major activity centers in a metropolitan area, and also serves the highest traffic corridors and satisfies the longest trip desires; and
- Carries the major portion of trips entering and leaving urban areas, as well as the majority of the through traffic desiring to bypass cities.

Arterial (examples include Smith Rock Way, Cook Avenue, Burgess Road):

- Provides service to trips of moderate length at a somewhat lower level of travel mobility than principal arterials; and
- Distributes travel to geographic areas smaller than those served by principal arterials, while not penetrating specific neighborhoods

Collector (examples include C Avenue in Terrebonne, Bailey Road):

- Provides both land access and traffic circulation within residential neighborhoods, commercial, and industrial areas; and
- Distributes trips from arterials through these areas to their final destination, and conversely, collects traffic from local streets and channels it onto arterials.

Local (examples include B Avenue in Terrebonne, 5th Street in Tumalo):

- Provides access to adjacent land and access to higher classified roads; and
- Provides lowest level of travel mobility including no bus routes; and
- Carries less than 1,500 vehicles per day.

Highways / Principal Arterials

ODOT has a policy to maintain and improve the safe and efficient movement of people and goods so that the State's transportation system will support the economy and community livability at local, regional, and state levels. Highways have the responsibility of facilitating traffic movement through and between urban areas, regions, and states. ODOT uses broad classifications to guide the agency in its facility management and investment decisions. The 1999 Oregon Highway Plan classifies State highways into five categories based on their function. Going from highest to lowest classification the five are: Interstate, Statewide, Regional, District, and Local Interest Roads. The higher classifications favor mobility over access while the lower classifications favor access over mobility.

Additionally, ODOT has several supplementary classifications for specific highway segments such as Expressway, Freight Route, and Special Transportation Area (STA). These supplementary classifications are an attempt to recognize that not only do highways differ from one another, but at times different segments of the same highway differ in regards to land use, roadside culture, geographic setting, speeds, etc. Expressways and Freight Routes generally favor through traffic whereas an STA is found in downtown areas, allowing more congestion and lesser access spacing standards.

All State highways in Deschutes County are classified as ***principal arterials.*** The principal arterial system consists of a connected network of continuous routes having the following characteristics:

1. Serve corridor movements having trip length and travel density characteristics indicative of substantial statewide or interstate travel.

2. Serve all, or virtually all, urban areas of 50,000 population and more and a large majority of those with population of 25,000 and more.

3. Provide an integrated network without stub connections except where unusual geographic or traffic flow conditions dictate otherwise.

With the exception of interstates, Deschutes County has representative examples of every ODOT classification. The principal arterial system is displayed in Figure 2.2.F2.

The U.S. highways in the County consist of:

US 97

Also known as The Dalles-California Highway #4, US 97 is the primary north-south route through Central Oregon, extending from California to the Columbia River. Truckers particularly prefer to utilize US 97 to OR 58 to reach the Upper Willamette Valley as this route skirts the rugged terrain and poor weather of the Siskiyou Mountains of southern Oregon.

ODOT classifies US 97 as a Statewide Highway, a Freight Route, and an Expressway. The Deschutes County TSP classifies US 97 as a Principal Arterial.

Since 1998, sections of US 97 in Bend have shifted from Third Street, a five-lane commercial arterial, to a four-lane limited access highway known as the Bend Parkway. A similar four-lane limited access segment called the Redmond Re-Route has replaced the US 97 couplet on Fifth and Sixth streets in downtown Redmond and the five-lane commercial arterial from downtown Redmond north to almost the O'Neil Highway. From downtown Redmond US 97 remains a five-lane arterial. Between Bend and La Pine, the highway is slowly becoming a divided four-lane highway to both reduce head-on crashes in winter and increase overall capacity.

A few sample points from ODOT's "2009 Traffic Volume Tables" indicate the range of average daily traffic (ADT) volumes on this highway.

- Jefferson/Deschutes County Line: 12,200 ADT
- O'Neil Highway: 18,300 ADT
- Quarry Avenue 25,100 ADT
- Bend @ Empire Ave 42,200 ADT
- South Century Drive 11,700 ADT
- 1st Street (La Pine) 9,000 ADT
- OR 31 5,800 ADT

US 97 carries substantial commuter traffic between Bend and Redmond and to a lesser extent from La Pine to Bend. The Bend-Redmond volumes are high enough that ODOT is contemplating a raised median between the two cities, coupled with a frontage road system and a grade-separated interchange at Quarry Avenue.

Oregon Highway Plan Policy 3B: Medians calls for non-traversible medians when daily traffic is expected to exceed 28,000 vehicles during the 20-year planning period. US 97 between Bend and Redmond is already above that threshold for much of its length. The frontage road and interchange system plus improvements to parallel local roads will lead to a reduction or even elimination of all at-grade accesses to US 97.

The daily volumes between Bend and La Pine are generally about half of those between Bend and Redmond. However, the highway is at a higher elevation between Bend and La Pine than Bend to Redmond, resulting in winter-related safety issues. Drivers traveling too fast over snow and ice can lose control, crossing over the centerline and causing head-on crashes. Additionally, US 97 cleaves southward through the dense pines of the Deschutes National Forest unlike the open country between Bend and

Redmond. The Bend-La Pine segment has more conflicts with wildlife, especially deer crossings. Between the elevation and the wildlife issue as well as an increase in traffic volumes over the next 20 years, the entire Bend-La Pine segment will also likely require a grade-separated median by 2030.

US 20

This highway's segments are known by various names. From the Jefferson/Deschutes County line it is the Santiam Highway #16; the McKenzie Highway #15 through Sisters; the McKenzie-Bend Highway #17 beginning at the east "Y" in Sisters; and the Central Oregon Highway #7 beginning at Third Street/Greenwood in Bend. US 20 is one of two major east-west routes through Central Oregon. US 20 extends from the Oregon coast at Newport, passes through Albany, then crosses the Cascades via Tombstone and Santiam Pass on its way to Sisters, then angles southeast to Bend and across the High Desert to Burns, crossing into Idaho at Ontario. US 20 traffic joins OR 126/OR 22 traffic at Santiam Junction and both enter Sisters where at the east "Y" Redmond-bound traffic continues on OR 126 while Bend and Burns traffic utilizes US 20.

US 20 east of Bend has flatter topography to cross than OR 126/US26, which parallels US 20 about 60 miles to the north. US 20 traverses across the sagebrush where the only pass it crosses in Central Oregon is Horse Ridge (elevation 4,291'), approximately 16 miles east of Bend. By contrast, OR 126 has a series of climbs through Ochoco Mountains and other ranges to the east. Thus, US 20 is the primary east-west truck route between the mid-Willamette Valley and Central Oregon. US 20 also has a fair amount of truck traffic extending into Idaho, but not as much as Interstate 84 along the Columbia.

ODOT classifies US 20 as a Statewide Highway, a Freight Route, and an Expressway. The Deschutes County TSP classifies it as a Principal Arterial.

A few sample points from ODOT's "2009 Traffic Volume Tables" indicate the range of average daily traffic (ADT) volumes on this highway.

- Black Butte Ranch 7,600 ADT
- Barclay Drive (Sisters) 9,400 ADT
- Three Sisters Viewpoint 8,900 ADT
- Cline Falls Highway 9,700 ADT
- Old Bend-Redmond 12,600 ADT
- Greenwood (Bend) 21,100 ADT
- 27th St. (Bend) 14,400 ADT
- Powell Butte Hwy 8,100 ADT
- OR 27 (Crooked River) 1,300 ADT
- Hampton 1,200 ADT

US 20 has seen an increase in commuter traffic from Sisters. Also as destination resorts have grown in Central Oregon, US 20 and OR 126 have been the most adversely affected state highways. East of Bend, the volumes drop dramatically. Traffic from Prineville reaches Bend by the Powell Butte Highway and US 20. The traffic volume on US 20 0.10 miles west of the Powell Butte Highway is 8,100 ADT whereas 0.10 miles east the load is 3,600 ADT.

By 2030 the combined increase in volumes on US 20 and Powell Butte Highway and Hamby/Ward will require intersection improvements. These are discussed more fully in Chapter 5, but in general the

proposal is for roundabouts provided the design is sufficient to accommodate the concerns of not impeding the movement of freight.

OR 126

This highway is known as McKenzie Highway #15 and Ochoco Highway #41. Statewide OR 126 extends west to east through Central Oregon, originating on the Oregon coast in Florence. It passes through the Willamette Valley via Eugene, through the Cascades via the Santiam Pass, then traverses Deschutes County by going through Sisters and Redmond. Ultimately, OR 126 ends in Prineville, terminating into US 26. Through Redmond, OR 126 uses several minor arterials (a Redmond road classification). OR 126 uses Highland Avenue from the 35th to 14th street, where the route splits into eastbound on Highland and westbound on Glacier. OR 126 briefly turns north on the Redmond Re-Route (US 97) before continuing east to Crook County on Evergreen.

A few sample points from ODOT's "2009 Traffic Volume Tables" indicate the range of average daily traffic (ADT) volumes on this highway. As US 20 and OR 126 follow the same route into Sisters, all examples are east of Sisters.

- 0.02 miles E of US 20 4,900 ADT
- Cline Falls Highway 8,500 ADT
- 35th St. (Redmond) 11,800 ADT
- US 97 (Redmond) 11,500 ADT
- 9th St (Redmond) 5,200 ADT
- Deschutes-Crook Co. Line 7,000 ADT

OR 31

A Regional Highway, also referred to as the Fremont Highway #19. The highway originates from US 97 just south of La Pine and extends southeast to US 395 at Valley Falls, connecting the south part of Deschutes County with Lakeview and the US 395 corridor in northeastern California. Only approximately two miles are in Deschutes County.

A few sample points from ODjOT's "2009 Traffic Volume Tables" indicate the range of average daily traffic (ADT) volumes on this highway.

- US 97 1,800 ADT
- Klamath-Lake County Line 800 ADT
- Picture Rock Pass 520 ADT
- Paisley 860 ADT
- US 395 620 ADT

OR 242

Otherwise known as the Old McKenzie Highway, OR 242 is a seasonal highway, meaning ODOT does not keep the historic and Oregon Scenic Byway open in winter. The highway often closes in mid-October and reopens in late June, although the weather determines the road's availability. Classified as a District Highway, the route leaves OR 126 near Belknap Springs in northeast Lane County, twists and turns over eponymous McKenzie Pass (5,325') which lies on the Deschutes County line, then descends into the west edge of Sisters, connecting to US 20/OR 126 near Pine Street. The road is popular in the

summer with motorcyclists, bicyclists, and sightseers. In winter snowmobilers, cross-country skiers, and snowshoers use the route.

A few sample points from ODOT's "2009 Traffic Volume Tables" indicate the range of average daily traffic (ADT) volumes on this highway.

- West snow gate 320 ADT
- Linn-Deschutes line 340 ADT
- 0.07 west of Sisters 1,700 ADT

OR 27

OR 27, also known as Crooked River Highway #14, this minor District highway has the dubious distinction of being the only graveled highway in the state. Crook County and ODOT have been incrementally paving the road south from Reservoir Road/OR 27 intersection, which is just south of Prineville Reservoir. The portion in Deschutes County is approximately four miles long and remains graveled. OR 27 connects to Highway 20 at a point between Millican and Brothers and extends north to Prineville along the Crooked River, a popular recreational section. OR 27 connects to OR 126 in downtown Prineville.

A few sample points from ODOT's "2009 Traffic Volume Tables" indicate the range of average daily traffic (ADT) volumes on this highway.

- 1.92 mi S of OR 126 320 ADT
- Reservoir Road 90 ADT
- 0.30 mi N of US 20 20 ADT

OR 372

Another District highway, OR 372 is best known as the Cascade Lakes Highway and like the Old McKenzie is closed seasonally past Mount Bachelor. The route is also called Century Drive or Century Drive #372. This highway connects the City of Bend with Mount Bachelor to the west. Beyond Mount Bachelor, the Cascade Lakes Highway becomes a Forest Service arterial serving the high country lakes south of Mt. Bachelor all the way to the Klamath County line. In the winter, the closed section is popular with snowmobilers.

A few sample points from ODOT's "2009 Traffic Volume Tables" indicate the range of average daily traffic (ADT) volumes on this highway.

- W Edge of Bend 3,300 ADT
- Edison Ice Cave Road 1,100 ADT
- End ODOT maintenance 980 ADT

O'Neil Highway

Rarely referred to as O'Neil Highway #370, this District highway originates at a point on US 97 between Redmond and the community of Terrebonne, and extends eastward to the City of Prineville, ending at OR 126. The route provides a crucial link between the surface mining sites in western Crook County and the construction markets in Redmond and Bend. Due to several tight curves near the Crook County community of Lone Pine, the route has length restrictions for trucks.

A few sample points from ODOT's "2009 Traffic Volume Tables" indicate the range of average daily traffic (ADT) volumes on this highway.

- US 97 1,900 ADT
- 33rd St 2,100 ADT
- Deschutes-Crook line 1,600 ADT
- Lone Pine 1,300 ADT
- OR 126 (Prineville) 1,900 ADT

Rural Arterials

These are county roads that are intended to provide interregional and intercity service and can have higher volumes when compared to other county roads. Rural arterials tie cities and larger towns to other major traffic generators. In some instances they provide parallel local facilities to the state highway system. These are often popular with area cyclists as they offer alternatives to the state highways and tend to have wider shoulders than county roads of a lower classification.

Below the Rural Arterials are described with those county roads that are Rural Arterials for their entire lengths presented first, followed by county roads that are designated as Rural Arterial for only a portion of their length. The traffic volumes are from the most recent years available.

Smith Rock Way

Smith Rock Way extends east from Terrebonne and after approximately three miles crosses into Crook County where the road eventually terminates at the O'Neil Highway by Lone Pine. Due to its proximity to the length-restricted O'Neil Highway, trucks often use Smith Rock Way as an alternate route, although Smith Rock Way does have weight-restricted bridges.

2008 traffic volumes

- 0.8 miles west of BNSF railroad tracks 2,373 ADT
- 0.04 miles west of 1st St (Terrebonne) 1,471 ADT
- Deschutes-Crook County line 880 ADT

Cline Falls Highway

A state highway until 1978, Cline Falls extends between Tumalo Road in Tumalo and OR 126 near Eagle Crest Resort. Cline Falls offers access to Cline Falls State Park off of OR 126 and is popular with area cyclists both for the road itself and access to mountain bike trails near Cline Buttes at the north end. The road provides access to western Redmond.

2009 traffic volumes
- 0.10 miles north of US 20 2,404 ADT

2007 traffic volumes
- 0.25 miles south of OR 126 3,684 ADT
- 0.05 miles north of Innes Market Road 2,494 ADT
- 0.10 miles north of US 20 2,968 ADT

Cook Avenue

The TSP Update reclassifies this road from a collector to an arterial, reflecting its increased importance and connection to Cline Falls Highway. The north-south Cook acts as the Main Street for Tumalo, tying the community to US 20. The road features sidewalks and paved bulbouts to reduce the crossing distance for pedestrians.

2009 traffic volumes
- 50' north of 4th St (Tumalo) 5,130 ADT

Old Bend-Redmond Highway/South Canal Boulevard

As the name implies, this was another state highway until 1978. Old Bend-Redmond offers a parallel local route to US 97 for those traveling between Bend and Redmond. The road is popular with area cyclists due to its relatively good shoulders and scenic connecting routes that link Old Bend-Redmond to Cline Falls Highway. Nearing Redmond the road becomes South Canal Boulevard.

Old Bend-Redmond Highway

2009 traffic volumes
- 0.06 miles north of US 20 3,004 ADT

2007 traffic volumes
- 0.10 miles north of Tumalo Road 2,763 ADT
- 0.10 miles south of Tumalo Road 2,129 ADT
- 0.10 miles north of Rogers Road 2,747 ADT
- 0.06 miles north of US 20 3,129 ADT

South Canal Boulevard

2008 traffic volumes
- 0.10 miles north of NW Helmholtz Way 3,448 ADT
- 0.10 miles south of SW Helmholtz Way 4,910 ADT
- 0.10 miles south of SW 61st St 2,621 ADT

Deschutes Market Road

The TSP Update reclassifies this collector back to its original Rural Arterial status. The road has seen a fair amount of growth in traffic volumes as northeast Bend has developed and since the completion of the Deschutes Junction interchange, which also removed an at-grade railroad crossing. Deschutes Market Road provides a parallel alternate route to US 97, albeit a brief one. Area cyclists enjoy the

road for its comparatively good shoulders, proximity to Bend, and the ability to make a loop using Deschutes Market/Tumalo Road to make a loop.

2009 traffic volumes
- 0.10 miles north of Hamehook 5,592 ADT

2008 traffic volumes
- 0.20 miles west of BNSF tracks 3,883 ADT
- 0.10 miles north of Hamehook Road 5,627 ADT
- 0.06 miles north of Butler Market Road 4,784 ADT

Powell Butte Highway

Powell Butte Highway is another former state highway that has been transferred to both Deschutes County and Crook County. Deschutes County took over its portion in 1988 and Crook County acquired the remainder in 2005. Within Deschutes County the road is now a rural arterial. Originating at Highway 20 about five miles east of Bend, the road connects the City of Bend northeastward past the Bend Municipal Airport to OR 126 near Powell Butte in Crook County. Approximately 20 miles in length with 14 of those in Deschutes County, the road has become a major commuting link between Bend and the community of Powell Butte as well as the City of Prineville. The road is also popular with local cyclists due to its lower traffic volumes, gentle terrain, and views of the Cascade Range and the Powell Buttes.

2009 traffic volumes
- 0.10 miles north of Butler Market Road 4,413 ADT

2008 traffic volumes
- 0.10 miles north of Butler Market Road 5,242 ADT
- 0.02 miles north of Nelson Road 4,688 ADT
- 0.015 miles north of Neff Road 4,912 ADT
- 0.10 miles north of US 20 5,346 ADT

Neff Road/Alfalfa Market Road

One of the few long-distance east-west rural arterials in the County, the route begins on the east side of Bend and provides access to Prineville Reservoir and the Crooked River Highway. The road is popular with area cyclists and motorcyclists, the latter enjoying its numerous horizontal and vertical curves between Stenkamp and Dodds roads.

Neff Road

2008 traffic volumes
- 0.08 miles west of Hamby Road 3,380 ADT
- 0.04 miles east of Hamby Road 3,325 ADT

2006 traffic volumes
- 0.10 miles east of Ericksen Road 2,101 ADT

Alfalfa Market Road

2008 traffic volumes
- 0.10 miles east of Powell Butte Hwy 2,641 ADT
- 0.04 miles east of Waugh Road 1,800 ADT
- 0.10 miles east of Stenkamp Road 1,550 ADT
- 0.15 miles west of Walker/Johnson Road 902 ADT

River Summit Drive (formerly called USFS #40/45 Road)
A former Forest Service facility, the road provides convenient access from Sunriver to Mount Bachelor and Edison Butte. As the road intersects Cascade Lakes Highway at its north terminus and US 97 at the south end, the route also provides access to the numerous High Cascade lakes. No ADT numbers are available.

Lower Bridge Way

The Rural Arterial portion at the north end of Terrebonne extends west from US 97 for about four miles to 43rd Street. This segment of Lower Bridge Way carries traffic mainly associated with access to Crooked River Ranch (CRR), a subdivision whose residents mainly live in Crook County. Farther west the Rural Collector portion of Lower Bridge Way provides an emergency secondary access to CRR.

2008 traffic volumes
- 0.05 miles west of US 97 5,288 ADT

2009 traffic volumes
- 0.10 miles east of 43rd St 5,245 ADT
- 0.05 miles west of 43rd St 697 ADT

Cooley Road

At the north end of Bend, Cooley provides an east-west connection between OB Riley and 18th Street, the bulk of the roadway lies within the City of Bend. Both the City of Bend and the County plans indicate an eventual extension east to Deschutes Market Road, although no timetable or funding has been identified.

2006 traffic volumes
- 0.10 miles west of US 20 514 ADT

Butler Market Road

This east-west road provides access from the City of Bend to the Bend Airport and the Powell Butte Highway. The three-mile segment sees a fair amount of commuter traffic coming from Prineville and western Crook County with destinations in north and northeast Bend.

2008 traffic volumes
- 0.10 miles west of Hamby Road 4,475 ADT
- 0.04 miles east of Hamehook Road 3,779 ADT
- 0.08 miles west of Powell Butte Hwy 3,493 ADT

Baker Road/Knott Road

These roads connect to the US 97 Baker Road interchange at the far south end of Bend. Baker Road provides access to the Deschutes River Woods neighborhoods just south of Bend and then connects to Brookswood Boulevard, Bend's west side ring road. Knott Road provides access to the Deschutes County Landfill before turning north and becoming 27th Street in Bend. The Knott/27th combination is the ring road for Bend's eastside. Some travelers use a routing of Knott Road to Rickard Road to reach US 20 to avoid the congestion of 27th Street which also intersects US 20 in east-central Bend.

Baker Road

2009 traffic volumes

- 0.10 miles west of Cinder Butte Road 6,174 ADT
- 0.10 miles west of US 97 8,404 ADT
-

Knott Road

2009 traffic volumes

- 0.10 miles east of US 97 6,269 ADT
- 0.20 miles east of 15th St (Bend) 6,508 ADT

2008 traffic volumes

- 0.25 miles west of 27th St (Bend) 6,039 ADT

Burgess Road

An east-west road that has some of the higher volumes on the County system due to its proximity to the City of La Pine and its access to the High Cascade Lakes via Pringle Falls Loop and South Century Drive. The roughly nine-mile arterial section runs between US 97 and Day Road.

2009 traffic volumes

- 0.15 miles west of US 97 7,922 ADT
- 0.08 miles east of Day Road 6,540 ADT

2008 traffic volumes

- 0.08 miles west of Day Road 3,098 ADT

Federal Forest Highways

These are a special classification of rural arterial that crosses federal lands to provide access to recreational attractions, trailheads, and scenic drives, primarily in the western and southern areas of the County. The *Oregon Forest Highway Long-Range Transportation Coordination Plan, 2010-2030* describes a Forest Highway as "a forest road under the jurisdiction of and maintained by a public authority and open to public travel." These roads are not under the jurisdiction of the Federal Highway Administration (FHWA). The federal vision is to balance the management objectives of "the United States Forest Service (USFS) with the transportation needs of visitors, recreationists, and resource users." There are 3,860 miles of Forest Highways within Oregon.

Of the 3,860 miles of Forest Highways in Oregon, 92 miles are in Deschutes County; the miles are either primarily or entirely within the Deschutes National Forest. The roads are necessary for access to forest resources so the resources can be administered, developed, protected, or used. Cascade Lakes Highway and Paulina Lake Road are closed in winter due to snow as are the higher elevation portions of China Hat Road.

Skyliners Road	Bend UGB to Tumalo Falls
Cascade Lakes Highway	Mount Bachelor to Klamath County line
USFS Road #41	Cascade Lakes Highway to River Summit Drive
Elk Lake Road	Loop to and from Cascades Lakes Highway
Three Trappers Road	Spring River Road to Cascade Lakes Highway
South Century Drive	Deschutes River to Cascade Lakes Highway
Cultus Lake Road	Cascades Lakes Highway to Cultus Lake
Keefer Road	South Century Drive to north end of Crane Prairie Reservoir
Twin Lakes Road	South Century Drive to South Twin Lake
Pringle Falls Loop	Burgess Road to South Century Drive
China Hat Road	End of pavement (near Knott) to Klamath County line
Paulina Lake Road	Paulina Creek to East Lake

Rural Collectors

Lower down in the functional classification hierarchy are ***collector*** streets and roads that enable people to move between the neighborhoods where they live, to the places they work, shop, and go to school. Collectors are the intermediate facility type, gathering traffic from local roads and delivering those volumes to arterials or principal arterials. In a rural setting, distance to a collector is a concern; the density of the road network relates to the population density.

The rural ***collectors*** in the County are identified below by general geographic area; these are the current designations with intended reclassifications described in parentheses.

Redmond/Terrebonne Area (Figure 2.2.F3)

NE 1st Street	NE Knickerbocker Avenue to NE Wilcox Avenue
NE 5th Street	O'Neil Highway to NE Eby Avenue
NW 10th Street	Upas (Redmond UGB) to NW Pershall Way
11th Street	US 97 to US 97
NE 17th Street	NE Upas Avenue to O'Neil Highway
NW 19th Street	NW Odem Way to NW Lower Bridge Way
NW 35th Street	~1,600 feet south of Maple to NW Upas Avenue
NW 43rd Street	NW Lower Bridge Way to NW Chinook Drive
NW 59th Street	NW Kingwood Avenue to NW Maple Avenue
SW 61st Street	S. Canal Blvd. to Highway 97
SW 63rd Street	SW Catlow Way to SW Obsidian Avenue
SW 67th Street	Beginning of grid to SW Catlow Way
NW 67th Street	Beginning of grid to NW Kingwood Avenue
Buckhorn Road	OR 126 to NW Lower Bridge Way
C Avenue	16th Street to NW 19th Street
N Canal Blvd.	U.S. 97 to Redmond City Limits/UGB
SW Catlow Way	SW 67th Street to SW 63rd Street
NE Cayuse Avenue	NE 5th Street to NE 9th Street

NW Chinook Drive	NW 43rd Street to Jefferson County line
Cline Falls Highway	OR 126 to Tumalo north border
NW Coyner Avenue	Pershall Way to NW Helmholtz Way
Deschutes Pleasant Ridge	US 97 to Deschutes Market Road (downgrade to local)
NE Eby Avenue	BNSF railroad to NE 5th Street
NW Eby Avenue	BNSF railroad to U.S. 97
NW Helmholtz Way	NW Maple Avenue to NW Coyner Avenue
SW Helmholtz Way	Canal bridge to S. Canal Blvd.
NW Ice Avenue	NW Wimp Way to NW 43rd Street
NE King Way	Redmond UGB to NE 17th Street
NW Kingwood Ave.	NW 59th Street to NW 67th Street
NE Knickerbocker Avenue	NE 1st Street to NE 5th Street
NW Maple Avenue	NW Helmholtz Way to NW 59th Street
NE Negus Way	Redmond UGB to NE Upas Avenue
SW Obsidian Avenue	SW 35th Street to SW 63rd Street
NW Odem Avenue	NW 10th Street to Northwest Way
NW Pershall Way	Highway 97 to NW Coyner Avenue
NW Upas Avenue	Northwest Way to NW 35th Street
SW Wickiup Avenue	SW Helmholtz Way to SW 58th Street
NE Wilcox Avenue	NE 1st Street to Crook County line

Bend Area (Figure 2.2.F4)

Arnold Market Road	Rickard Road to Gosney Road
Baker Road	Brookswood to Shoshone
SE Bear Creek Road	Bend UGB to Ten Barr Road
Bennett Road	Alfalfa Market Road to NE Bear Creek Road
Cinder Butte Road	Baker Road to Minnetonka Lane to end of pavement
Dickey Road	Butler Market Road to Erickson Road
Dodds Road	US 20 to Alfalfa Market Road
Erickson Road	US 20 to Dickey Road
Gosney Road	US 20 to Arnold Market Road
Hamby Road	US 20 to Butler Market Road
Hamehook Road	Butler Market Road to Deschutes Market Road
Johnson Ranch Road	Alfalfa Market Road to Crook County line
McGrath Road	Morrill Road to Stenkamp Road
Minnetonka Lane	Kiowa Road to Cinder Butte
Plainview Road	Highway 20 to Gist Road
Rickard Road	Knott Road to US 20
Stenkamp Road	McGrath Road to Alfalfa Market Road
Ward Road	US 20 to Gosney

Sisters Area (Figure 2.2.F5)

Buffalo Road	Wilt Road to Mountain View Road (downgrade to local)
Camp Polk Road	OR 126 to Sisters UGB
Cloverdale Road	US 20 to OR 126
Fryrear Road	US 20 to OR 126
Gist Road	US 20 to Plainview Road
Indian Ford Road	Camp Polk Road to Green Ridge Road

Plainview Road	Gist Road to US 20
Three Creek Road	Sisters UGB to Forest Service Road #1600-210
Wilt Road	Camp Polk Road to end Pavement

Tumalo Area (Figure 2.2.F6)

Bailey Road	US 20 to Tumalo Reservoir Road
Cook Avenue	North end of Tumalo to US 20 (upgrade to arterial)
Couch Market Road	US 20 20 to Collins Road
Johnson Market Road	Tyler Road to Tumalo Reservoir Road
Tumalo Road	Graystone Lane to Cline Falls Highway
Tumalo Reservoir Road	OB Riley Road to Collins Road
Gerking Market Road	US 20 to Innes Market Road
Collins Road	Couch Market Road to Tumalo Reservoir Road
Innes Market Road	US 20 to Cline Falls Highway

Sunriver and South County Area (Figure 2.2.F7)

5th Street	Amber Lane to La Pine State Recreation Road
6th Street	US 97 to Dorrance Meadow Road (transfer to City of La Pine up to Pengra)
Amber Lane	Deep Woods Road to 5th Street
Burgess Road	Highway 97 to Sunset Court (transfer to City of La Pine up to Lost Ponderosa Road)
Cottonwood Road	Highway 97 to Railroad crossing
Day Road	Burgess Road to Amber Lane
Dorrance Meadow Road	Burgess Road to 6th Street
Finley Butte Road	Highway 97 to Darlene Way (transfer to City of La Pine up to City's eastern boundary)
Huntington Road	South Century Drive to La Pine RSC (transfer to City of La Pine beginning at City's northern limit, approximately 750' south of Huntington/Riverview intersection)
La Pine State Recreation Rd	Highway 97 to Foster Road (FS #4205)
Lazy River South Drive	Huntington Road to Otter Drive
Masten Road	US 97 to end of pavement
Paulina Lake Road	US 97 to Paulina Creek Bridge
Prairie Drive	US 97 to Huntington Road
Reed Road	US 97 to Darlene Way (transfer to City of La Pine)
Riverview Drive	Otter Drive to Huntington Road
South Century Drive	US 97 to Maxwell Bridge across Deschutes River
Spring River Road	South Century Drive to Forest Service boundary (upgrade to arterial)
Vandevert Road	US 97 to South Century Drive

Traffic Control Devices

Traffic control devices include a wide range of technology including signs, roundabouts, signals, and pavement markings used to regulate, guide, or warn traffic. The TSP concentrates, however, on the major traffic control devices and not on signs or pavement markings. Figure 2.2.F8 displays the traffic control devices on County roads. The traffic signals on State highways are located in the cities, not on rural lands where they would not meet driver expectations.

Roundabouts - The County constructed its first roundabout at the intersection of South Century Drive/Abbott Drive, which is the southern entrance to Sunriver.

Traffic Signals - No traffic signals occur in the rural areas of the County as such a traffic control device would not meet driver expectations. Typically, on rural County roads drivers are traveling at speeds greater than 45 to 50 mph and have been for doing so without interruption for distances that are greater than if they were in an urban area. The combination of rate and duration of speed as well as roadside culture results in drivers not expecting to stop for a traffic signal in a rural setting.

Traffic signals are located in more urban-like settings at intersections where the traffic volumes are fairly high both on the mainline and the cross streets. The volumes are sufficiently high enough that stop signs on either just the side streets or all four legs of the intersection would result in long delays and excessive queuing.

The County has constructed traffic signals at the following locations:

- South Century Drive/Venture Lane (entrance to Sunriver Business Park)
- Huntington Road/1st Street (now in City of La Pine)
- Huntington Road/Burgess Road (now in City of La Pine)

Flashing Warning Lights - Red and/or yellow flashing warning lights generally are located at intersections where a full stop light control is not yet warranted and four-way stop signs would not meet the need to balance safety concerns and through traffic movement.

For stop-controlled intersections where there has been a documented history of drivers running the stop sign, the County has begun using flashing red lights that outline the perimeter of the stop sign. These are expected to increase driver compliance.

Yellow flashing lights can also occur at school crossings and railroad crossings, etc. Often, typical speeds on the roads approaching an intersection may not give drivers enough time to react; therefore flashing red lights are placed over the intersection to alert drivers in advance of a four-way stop.

In some cases, the yellow flashing light is facing traffic on the cross street with a higher functional classification and the red flashing light faces drivers on the lesser classified street causing them to stop before entering the intersection. Commonly, a red or yellow flashing light facing all intersecting streets would denote similar functional classifications. These warning lights occur in the County at the following intersections:

1. US 97 (yellow) / Smith Rock Way (red)
2. US 97 (yellow) / O'Neil Highway (red)
3. Northwest Way (post-mounted yellow)/Coyner Road (post-mounted red)
4. Cline Falls Highway (post-mounted yellow)/Tumalo Road (post-mounted red)

5. Old Redmond-Bend Highway (yellow) / Tumalo Road (red)
6. Butler Market (red)/Hamby Road (northbound red, southbound yellow)
7. Neff Road (red)/Hamby Road (red)
8. US 20 (yellow) / Hamby-Ward roads (red)
9. Powell Butte Highway (yellow) / Neff Road (red)
10. Knott Road (post-mounted yellow)/China Hat Road (post-mounted red)

Previous locations on the state highway system that had flashing beacons became interchanges (US 97/Deschutes Market-Tumalo roads and US 97/South Century Drive) or were replaced by traffic signals in urban locations (Burgess/Huntington).

Performance Standards

Both Deschutes County and ODOT set mobility standards for their respective facilities to ensure the roads and highways operate safely and efficiently. Previously, both the County and ODOT used LOS but the State in 1999 shifted to volume/capacity (v/c) ratio. These performance standards are used to identify current or future deficiencies, assess proposed transportation improvement projects, and to review the effects of proposed land use applications upon County roads and/or State highways.

Levels of Service (standard for County roads)
In order to effectively communicate about traffic flow and traffic capacity conditions, the engineering and planning professions have adopted a concept of level of service to describe traffic conditions and associated traffic flow rates. Six levels of service designations ranging from A to F are typically recognized by the transportation professions. For County roads LOS concerns the capacity of a given segment to accommodate a moving stream of vehicles. The LOS description generally describes a motorist's perception in terms of speed, travel time, freedom to maneuver, free flow vs. interruptions, comfort, convenience, and safety. LOS A has free-flow traffic whereas LOS F is stop and go traffic. The County sets LOS D as the mobility standard for existing roads and LOS C for new County roads. At LOS D, traffic is approaching unstable flow rates whereas LOS C traffic flow is stable.

For rural, two-lane roads in the County, the peak hour traffic volumes were assumed to be ten percent (10%) of the average daily traffic amount, then further adjusted to reflect a desirable flow rate. For Deschutes County, LOS was determined based on the relationship of general capacity to average daily traffic (ADT) for level terrain. For a ten percent (10%) peak hour flow, the corresponding ADT and LOS are identified in Table 2.2.T2. LOS D was selected as it allows traffic to flow overall at acceptable rates. Establishing a LOS B or LOS C as the standard would result in the County constructing multilane roadways on roads that do see much traffic. An urban analogy would be building a parking lot to accommodate the demand of the retail rush on the day after Thanksgiving.

Table 2.2.T2

Generalized County Road Segment ADT and LOS

Level of Service	Characteristics	ADT
A	A free-flow condition with individual users unaffected by the presence of others in the traffic stream.	<1,700
B	Stable flow with a high degree of freedom to select speed and operating conditions but with some influence from other users.	1,701-3,400
C	Restricted flow which remains stable but with significant interactions with others in the traffic stream. The general level of comfort and convenience declines noticeably at this level.	3,4001-5,700
D	High-density flow in which speed and freedom to maneuver are severely restricted and comfort and convenience have declined even though flow remains stable.	5,701-9,600
E	Unstable flow at or near capacity levels with poor levels of comfort and convenience.	9,601-16,299
F	Forced flow in which the amount of traffic approaching a given point exceeds the amount that can be served and queues form which are characterized by stop and go waves, poor travel times, low comfort and convenience, and increased accident exposure.	>16,300

Source: 2000 Highway Capacity Manual; Deschutes County staff

The remaining capacity of a roadway forms the basis for most transportation planning and design decisions and actions. Table 2.2.T3 and Figures 2.2.F9-F12 identify the estimated LOS for County roads in 2009.

Most planning applications deal with future conditions and involve estimates of traffic, transit or pedestrian flows. Therefore, reasonable order-of-magnitude estimates of capacity are usually adequate. Transportation capacity reflects the ability of a roadway to carry vehicles or people, under the prevailing conditions of operation. In general, capacity represents the maximum hourly rate (usually the peak hour) at which a number of people or vehicles pass a given point within a specific time period under prevailing conditions. The ***desirable*** flow rate is usually somewhat less since it introduces the qualitative aspect of a specified LOS.

The above discussion focused on roadway segments, but LOS is also used for intersections, both signalized and unsignalized. For an intersection, the LOS is based on the amount of delay in seconds for drivers to either enter or cross an intersection. With the three exceptions described above, all intersections in the unincorporated areas of Deschutes County are currently unsignalized. Two-way stop or yield controls are common on arterial streets and highways. As cross-street volumes increase, these intersections can reach capacity limits and produce significant delays to cross-street vehicles as well as accident potential. Four-way stop control is often an interim phase preceding signalization. Calculations of unsignalized intersection capacity are based on a simplifying assumption that minor street traffic does not affect the traffic flow on the major street. In reality, when congestion occurs, the major flows are probably affected to some degree by minor street traffic and left turns, all conflicting traffic movements affect minor street traffic.

Table 2.2.T3

Top County 2009 Rural Road Volumes and Estimated LOS

Rank	Rd-Seg	Road Name	From	To	Count	ADT	LOS	Func. Class
LOS D Segments								
1	3006-10	Baker Rd	US 97	Cinder Butte	2009	8,404	D	Rural Arterial
2	4106-30	Burgess Rd	Glenwood Drive	La Pine City Limits	2009	7,922	D	Rural Arterial
3	3161-50	27th St	Ferguson Road	Rickard Road	2008	7,862	D	Rural Arterial
4	4112-10	South Century Dr	Sewage Treatment Road	Spring River Road	2009	6,748	D	Rural Arterial
5	4106-40	Burgess Rd	La Pine City Limits	Pine Forest Road	2009	6,540	D	Rural Arterial
6	3168-55	Knott Rd	SE 15th	Raintree Road	2009	6,508	D	Rural Arterial
7	3168-10	Knott Rd	US 97	China Hat Road	2009	6,269	D	Rural Arterial
8	3006-10	Baker Rd	US 97	Brookswood	2009	6,174	D	Rural Arterial
9	3168-60	Knott Rd	Raintree Road	Rickard Road	2008	6,039	D	Rural Arterial
10	4112-05	South Century Dr	US 97	Sewage Treatment Rd	2009	5,987	D	Rural Arterial
LOS C Segments								
11	3181-40	Deschutes Mkt Rd	Bend UGB	Hamehook Road	2008	5,627	C	Rural Collector
12	4101-35	Huntington Rd	Burgess Road	La Pine UGB	2009	5,502	C	Rural Collector
13	2194-30	43rd St	NW Ice Ave	NW Chinook Ave	2009	5,445	C	Rural Collector
14	3181-10	Deschutes Mkt Rd	US 97	Dale Road	2010	5,344	C	Rural Collector
15	2177-10	Lower Bridge Way	US 97	27th Street	2008	5,288	C	Rural Arterial
16	2303-10	Chinook Dr	NW 43rd Street	Jefferson County line	2009	5,247	C	Rural Collector
17	2177-20	Lower Bridge Way	NW 27th Street	NW 43rd Street	2009	5,245	C	Rural Arterial
18	4112-30	South Century Dr	Huntington Road	Snow Goose Road	2009	5,216	C	Rural Collector
19	1171-10	Cook Ave	Cline Falls Hwy	US 20	2009	5,130	C	Urban Collector
20	4112-25	South Century Dr	Vandevert Road	Huntington Road	2009	5,078	C	Rural Collector
21	3518-55	Powell Butte Hwy	Erickson Road	Alfalfa Market-Neff Rd	2008	4,912	C	Rural Arterial
22	2130-40	S. Canal Blvd	Northwood Drive	Deedon Road	2008	4,910	C	Rural Arterial
23	2194-20	43rd St	NW Lower Bridge Way	NW Ice Avenue	2009	4,844	C	Rural Collector
24	3181-70	Deschutes Mkt Rd	Yeoman Avenue	Bend City Limits	2008	4,784	C	Rural Collector

Rank	Rd-Seg	Road Name	From	To	Count	ADT	LOS	Func. Class
LOS C Segments								
25	3518-50	Powell Butte Hwy	Butler Market Rd.	Erickson Road	2008	4,688	C	Rural Arterial
26	4112-15	South Century Dr	Spring River Road	Caldera Entrance (MP 3.0)	2009	4,492	C	Rural Collector
27	3182-60	Butler Mkt Rd	Bend UGB	Hamby Road	2008	4,475	C	Rural Arterial
28	4106-10	Burgess Rd	US 97	Pine Drive	2008	4,454	C	Rural Arterial
29	3518-45	Powell Butte Hwy	McGrath Road	Butler Market Road	2008	4,413	C	Rural Arterial
30	4111-10	Day Rd	Burgess Road	Northwood Drive	2008	4,231	C	Rural Collector
31	3518-60	Powell Butte Hwy	Alfalfa Mkt.-Neff Road	US 20	2009	4,083	C	Rural Arterial
32	4192-10	Spring River Rd	South Century Drive	Solar Drive	2008	3,959	C	Rural Arterial
33	3173-30	Neff Rd	Bend City Limits	Hamby Road	2008	3,830	C	Rural Arterial
34	3182-80	Butler Mkt Rd	Hamehook Road	Silvis Road	2008	3,779	C	Rural Arterial
35	1148-10	Cline Falls Hwy	OR 126	Eagle Crest Entrance	2007	3,684	C	Rural Arterial
36	3518-10	Powell Butte Hwy	0.5 mile S of Crook Co line	1.5 miles S of Crook Co line	2008	3,617	C	Rural Arterial
37	3182-90	Butler Mkt Rd	Silvis Road	Powell Butte Highway	2008	3,493	C	Rural Arterial
38	2130-35	S .Canal Blvd	SW 39th Street	SW Helmholtz Way	2008	3,448	C	Rural Arterial
LOS B Segments								
39	3195-20	Hamby Rd	Neff Road	Fletcher Lane	2008	3,349	B	Rural Collector
40	1161-60	Camp Polk Rd	Milepost 5	Milepost 6	2009	3,348	B	Rural Collector
41	3173-40	Neff Rd	Hamby Road	Erickson Road	2008	3,325	B	Rural Arterial
42	4143-10	Cottonwood Rd	US 97 (SB decel lane)	US 97 (SB accel lane)	2009	3,289	B	Rural Collector
43	3025-20	River Woods Dr	Lakeview Road	Kiowa Road	2008	3,132	B	Rural Local
44	4106-60	Burgess Rd	Pine Forest	Dorrance Meadows Road	2008	3,098	B	Rural Collector
45	3175-10	Rickard Rd	SE 27th St/Knott Road	Arnold Market Road W	2009	3,053	B	Rural Collector
46	2156-30	Old Bend Redmond Hwy	Rogers Road	US 20	2009	3,004	B	Rural Arterial

Source: Deschutes County Road Department

For unsignalized intersections involving County roads only, the performance standards is LOS D, which is defined as more than 25 seconds but less than 35 seconds delay on average per vehicle. Based on that performance standard and the results of ODOT's traffic model for Deschutes County, the following intersections were found to be either already exceeding or were close to exceeding LOS D:

- Neff-Alfalfa Market Roads/Powell Butte Highway
- Butler Market Road/Powell Butte Highway
- Tumalo Road-Cook Avenue/Cline Falls Highway

For signalized intersections involving County roads only, the performance standard is LOS D, which is defined as more than 35 seconds and less than 55 seconds per delay per vehicle. (The amount of delay is higher because drivers accept longer delays as the presence of a traffic signal assures drivers they will ultimately be allowed to make their desired movement.) None of the three signalized intersections in the County exceed that standard.

Volume/Capacity Ratio (standard for State highways)

While LOS relies more heavily on subjective features, Volume/Capacity (V/C) ratios are mathematically derived from the peak hour volume of a highway segment or intersection divided by its theoretical capacity. For example, a V/C of 0.70 means peak hour traffic consumes 70 percent of the highway's capacity, leaving 30 percent unused. As V/C exceeds 0.95 the traffic flow becomes unstable and 1.0 is maximum congestion. The applicable V/C ratios for State highways are shown in Table 2.2.T4 and Figure 2.2.F13.

ODOT sets the V/C standard for highway segments based on their functional classification, supplemental designations, and urban or rural location. For unincorporated Deschutes County, the main highways (US 97, US 20, OR 126) are Statewide Highways and the Freight Route designation applies to both US 97 and US 20; additionally much of these two highways are also designated Expressways. In general, ODOT desires more reserve capacity on the mainline and less on the side streets. For example, a rural highway can have a performance standard 0.70 V/C whereas the intersecting local road has performance standard of 0.80 V/C. Unlike the County's LOS performance standard, the ratio does not make a distinction between roadway segments and intersections. For certain segments in Unincorporated Communities, such as Terrebonne or Tumalo which are quasi-urban, ODOT allows more congestion.

Table 2.2.T4

Maximum Volume to Capacity Ratios Outside of Urban Growth Boundaries

Highway Category	Unincorporated Communities	Rural Lands
Statewide (NHS) Expressways	0.70	0.70
Statewide (NHS) Freight Routes	0.70	0.70
Statewide (NHS) Routes	0.75	0.70
Regional Highways	0.75	0.70
District Highways/Local Roads	0.80	0.75

Source: Oregon Highway Plan

Traffic Volumes

County Roads

The Deschutes County Road Department conducts average daily traffic (ADT) and peak hour traffic volume counts on a rotating basis for all arterials and collector roads in the County. Each road is counted on average once every one to four years based on previous volumes. Higher volume roads are counted more frequently.

Vehicles per day	Counted
>5,000	Annually
>3,000-4,999	Every other year
>1,000-2,999	Every third year
<999	Every fourth year

Historically, traffic volumes on the County's roads have grown by two to three percent annually. However, beginning in 2007 traffic volumes have remained either essentially flat or have actually declined due to the national and regional economic downturn. The loss of jobs and rising fuel costs have resulted in less travel. The traffic count information was assembled in a spreadsheet and the most recent counts from 2007-2009 were used. The data indicate all County roads perform acceptably. Even Baker Road, the most heavily traveled road on the County system, has approximately 15 percent of its capacity remaining. *Technical Memorandum #2, Existing Traffic Conditions*, in Appendix B provides more detail.

The *2000 Highway Capacity Manual* states the capacity of a two-lane highway is 1,700 passenger cars per hour per direction of travel with a maximum of 3,200 passenger cars per hour per both directions. (The total intentionally does not equate to 3,400 passenger cars per hour for both directions due to geometry, passing opportunities, accesses, etc.) While state highways have passing or climbing lanes, currently there are no passing or climbing lanes on the County-maintained system; all County roads are two-lane roads with left- and/or right-turn lanes at selected major intersections.

Table 2.2.T3 which was referenced earlier, identified the County roads with a significant volume (>3,000 ADT) in 2007-2009. The bulk of County roads carry a very low volume due to the rural land uses that abut the roads. The rural uses simply do not generate much traffic. The major traffic generators in the County are destination resorts and the larger unincorporated communities of Sunriver, Terrebonne, and Tumalo, and Deschutes River Woods, a rural subdivision abutting Bend. Mount Bachelor and the High Cascades Lakes generate winter and summer seasonal traffic, respectively.

Of the 310 miles of County-maintained rural arterials and collectors, only 13% (40 miles) carry 3,000 or more average daily trips. The County rural road with the highest ADT volume in 2007-09 was Baker Road, just west of Highway 97 at the south edge of Bend, with 8,404 ADT. Interestingly, the same segment was also the highest traveled segment in the 1996, but with 9,090 ADT. The drop of more than 600 ADT or 7.55% again shows the effect of the region's economic downturn. Of the top ten segments for traffic volumes, six are on the margins of Bend, two are on the periphery of La Pine, and two are by Sunriver.

In 1996, there were four segments that were at Level of Service (LOS) D, the County's minimum standard, with two at the margins of Bend and by La Pine. In 2009, there were ten segments at LOS D.

State Highways

State highway traffic volumes within Deschutes County vary widely with lower volumes in the rural areas and higher volumes within or near the region's cities. The traffic count information comes from the Oregon Department of Transportation's document *2009 Traffic Volume Tables*. The heaviest traveled highway in the County is US 97 with 2009 average daily volumes ranging from 12,200 at the northern County line to 27,000 within Redmond to 42,200 within the City of Bend, and 5,800 at the south county line. The next most traveled highway is US 20 with ADTs ranging from 7,600 west of Black Butte Ranch to 9,400 within Sisters, to 21,400 within Bend, then dropping off significantly east of Powell Butte Highway to 3,600 then decreasing easterly through Millican, Brothers and Hampton to approximately 1,200.

Table 2.2.T5 and Figure 2.2.F13 show the existing (2009) volumes for State highway segments in the County. *Technical Memo #2, Existing Traffic Conditions,* defined highway segments as being "high risk" if the model indicated a V/C of greater than 0.80 and "medium risk" if the segment had a V/C of 0.60 to 0.79.

No State highway segment was at high risk, but six segments were at medium risk. The State highway system has many segments that are either multi-lane (more than one travel lane in each direction) or have passing or climbing lanes.

Also the State's standards are more restrictive than the County's. Therefore, the same traffic volumes on a two-lane roadway would be assessed as a medium risk under the State's V/C ratio but that same volume would be acceptable under the County's LOS performance standard.

Table 2.2.T5

Medium Risk State Highway Segments, 2009

Highway	Milepoint Start	Milepoint End	Average ADT
US 97	115.23	117.34	16,300
US 97	151.05	153.08	17,100
US 20	14.48	14.72	14,700
O'Neil	0.78	0.86	2,300
Century Drive	10.62	11.75	2,500
Century Drive	18.77	18.81	1,050

Source: ODOT Traffic Volume Tables, *Technical Memo #2, Existing Conditions*

Tech Memo #2, Existing Traffic Conditions, analyzed unsignalized intersections currently either meeting or nearly meeting the Preliminary Signal Warrant (PSW). The PSW is an indicator of either substantial delay on the side street or the traffic from the side street has difficulty entering the mainline. Therefore, the PSW identifies intersections that are experiencing or nearing poor performance, but that does not mean a traffic signal is the solution. The following intersections, organized by highway and not priority, already meet the PSW or nearly do:

- US 97-Lower Bridge Way
- US 97/Smith Rock Way
- US 97/O'Neil Highway-Pershall Way
- US 97 Southbound on and off ramps/Baker Road
- US 97 Northbound off ramp/Knott Road-Baker Road
- US 97-Vandevert Road
- US 97/OR 31

- US 20/Cook Avenue-O.B. Riley Road
- US 20/Old Bend-Redmond Highway
- US 20/Powell Butte Highway
- OR 126/Helmholtz Way

Safety Analysis

Traffic volumes are just one aspect of the operational safety of the transportation system. Other factors include geometry and operating conditions (night or day, type of surface, season, etc.). Crashes are then analyzed for crash data for a multi-year period to look at severity, frequency, and crash rate, and whether there is any type of spatial pattern. Generally, a crash rate of less 1.0 per million vehicle-miles traveled (VMT) is acceptable on a road segment. Similarly, a crash rate for an intersection of less than 1.0 per million entering vehicles (MEV) is acceptable. By acceptable, it is meant the crash rate indicates these are random events and do not evidence a systematic problem. The top rural accident locations for County roads and for state highways are identified in Figure 2.2.F14 and Tables 2.2.T6, 2.2.T7, and 2.2.T8.

County Roads

Table 2.2.T6 and Figure 2.2.F14 list the crash sites on the County road network from 2005-2009. None of the intersections exceed a crash rate of 1.0 per MEV. *Technical Memo #2, Existing Conditions* looked at crash data from 2002-2006. Of the top three intersections on that list with a crash rate of greater than 1.0 per MEV (Hamby/Neff; Coyner/Northwest Way; Old Bend-Redmond Hwy/Tumalo) by 2009 none had a crash rate greater than 0.50 MEV. Between 2002 and 2008 the County had installed a four-way stop at Hamby/Neff and added a flashing red beacon to the stop sign at Coyner/Northwest Way.

Table 2.2.T6

Top Intersection Crash Locations on County Roads, 2005-2009

Ranking	Main Street	Cross Street	Traffic Control	Crashes	MEV Rate
1	Northwest Way	Coyner Ave	TWSC	16	0.433
2	Old Bend-Redmond	Tumalo Road	TWSC	15	0.329
3	Deschutes Mkt Rd	Dale Road	TWSC	17	0.312
4	Lower Bridge Way	43rd Street	TWSC	13	0.312
5	South Century Dr	Huntington Road	TWSC	16	0.302
6	Neff Road	Hamby Road	AWSC	16	0.261
7	Powell Butte Hwy	Neff-Alfalfa	TWSC	16	0.260
8	Burgess Road	Day-Pine Forest	TWSC	15	0.231
9	South Century Dr	Vandevert Road	TWSC*	12	0.210
10	Huntington Road	Burgess Road	Signal	18	0.210
11	Deschutes Mkt Rd	Hamehook Road	TWSC**	10	0.177
12	Knott Road	China Hat Road	TWSC	10	0.158

Source: Deschutes County Road Department

AWSC = All-way stop controlled, i.e., stop signs on every leg of the intersection
MEV = Crash rate per million entering vehicles
TWSC = Two-way stop controlled, i.e., stop sign on cross street
* Three-legged intersection with stop sign on east leg (Vandevert)
**Three-legged intersection with stop sign on north leg (Deschutes Market Road)

Additionally, *Technical Memo #2, Existing Conditions,* looked at crash rates for County roadway segments. The crash rates for these segments were then compared to the 2007 *State Highway Crash Rate Table*, for the five-year statewide average for similar facilities. The 2007 data indicated a crash rate of 1.24 for rural major collectors and 0.86 for urban collectors. The only County roadway segments to exceed those benchmarks were:

- Pershall Way, 1.56 crash rate for its 3.3 miles
- North Canal Boulevard, 1.35 crash rate for its 3.0 miles
- Hamby Road, 1.27 crash rate for its 4.8 miles
- Burgess Road, 0.89 crash rate for its 10.2 miles

Pershall Way

Of six crashes on this roadway, two were fixed object collisions, two were non-collision crashes (phantom vehicle) and two were rear-end collisions. All but the fixed object crashes were Property Damage Only (PDO) collisions. There were no fatalities. The weather was clear for all crashes. Icy roadways were a factor in two crashes and all but one crash occurred in daylight. The crashes were attributed to several driver errors including improper driving, reckless driving, speeding, following too closely and inattention. Recoverable slopes (meaning the width and grade of the shoulder and roadside ditches) clear of rocks, fences or other obstacles would have been of benefit in about half of these crashes.

North Canal Boulevard

Two crashes occurred and both were under clear dry daylight conditions. Both crashes were driver error with a fixed object crash near US 97 caused by driving too fast for conditions. The other crash happened when the passer's vehicle sideswiped the vehicle it was overtaking.

Hamby Road

The fourteen crashes mostly occurred in dry, dark conditions. There were no fatalities. All but four of the segment crashes were fixed object crashes. Of the four, two were pedestrian crashes; the other two were angle and rear-end crashes. The crashes were attributed to some form of improper driving, speeding, following too closely or inattention. Alcohol was involved in one of the crashes. Countermeasures could include recoverable slopes, clear zones and shoulder improvements.

State Highways

Of the 626 reported crashes on state highways in Deschutes County between 2005 and 2007, the majority of crashes were fixed object collisions (44%). These fixed object crashes may be caused by lack of illumination, poor pavement conditions, poor weather conditions, driver fatigue, etc. Other collision types ranged from 5 to 20 percent. The vast majority (79%) of crashes were under daylight conditions. About half of the crashes occurred under snow, ice, or wet conditions. About a quarter of crashes occurred at intersections. The total crashes involving trucks were eight percent.

ODOT uses the Safety Priority Index System (SPIS) to identify locations where mitigations can provide the highest safety cost-benefit based on crash type, severity, crash rate. ODOT also keeps a statewide data base to compare the crash rate for similar types of highways based on their classification and context. The SPIS score is based on three years of crash history based segments that are a tenth of a mile in length. A segment becomes a SPIS site if:

- A location has three or more crashes; or
- One or more Injury A (life-threatening); or
- A fatal crash over a three-year period

Out of UGB , there were four top 10% SPIS sites in Deschutes County between 2005 and 2007. A trio was on US 97 and one was on US 20. The segments were:

- US 97/MP 128.49-128.67 (Gift-Deschutes Pleasant Ridge), 12 crashes, one fatal and two Injury A
- US 97/Milepoint 146.39-146.59 (vicinity of ODOT weigh station), six crashes, one fatal and one Injury A
- US 97/Milepoint 168.10-168.28 (6th Street in La Pine), seven crashes, one fatal and one Injury A
- US 20/Milepoint 14.53-14.71 (Bailey-7th Street), 17 crashes, no fatals and three Injury A's.

For US 97/Gift-Deschutes Pleasant Ridge, ODOT and the Board of County Commissioners agreed in 2010 to disconnect Deschutes Pleasant Ridge from the east side of US 97. For US 20, ODOT installed a raised median also in 2010, making 7th a right-in, right-out only (RIRO) and Bailey into a RIRO and a left-in. The City of La Pine, ODOT, and Deschutes County in 2011 are preparing a facility management plan for US 97 to improve operations, reduce crashes, and enhance bike/pedestrian travel and crossings. ODOT is looking at countermeasures such as raised medians and divided lanes for US 97 between Bend and the Cottonwood interchange at the north end of Sunriver.

Besides those SPIS locations, ODOT also tracks highway segments which exceed the average rate for the rural highway system. This enables the agency to see how area highways compare to the statewide average for both frequency and severity. Table 2.2.T7 shows high frequency locations.

Table 2.2.T7

Segments Exceeding State Highway Crash Rates, 2005-2007

Highway Segment	ADT	3-Yr Crash Rate	Avg Rural Hwy Sys Rate
US 97 (The Dalles-California Hwy #4)			
MP 168.18 - 169.68	6,650	1.10	0.71
OR 242/OR 126 (McKenzie Hwy #15)			
MP 77.14 - 91.11	535	1.34	1.17
MP 107.77 – 110.15	11,000	0.94	0.71
US 20 (Santiam Hwy #16)			
MP 90.85 – 92.85	5,100	1.34	0.71
US 20 (McKenzie-Bend Hwy #17)			
MP 5.30 – 7.87	8,700	0.90	0.71
MP 7.87 – 9.72	9,100	1.19	0.71
MP 14.30 – 17.48	13,600	0.84	0.71
OR 31 (Fremont Hwy #19)			
MP 0.00 – 2.31	1,900	1.46	0.99
US 20 (Central Oregon Hwy #7)			
MP 4.80 – 9.16	3,250	0.97	0.71
OR 370 (O'Neil Hwy #370)			
MP 0.00 – 3.84	1,950	1.10	0.99
OR 372 (Century Drive Hwy #372)			
MP 8.43 – 11.43	2,500	1.34	0.99
MP 11.43 – 16.87	2,100	1.04	0.99
MP 16.87 – 19.19	2,100	1.50	0.99
MP 19.19 – 21.98	2,000	1.64	0.99

Source: ODOT, Traffic Crash Summary

In addition to frequency, ODOT tracks the severity of crashes. Table 2.2.T8 lists crash sites that are in the SPIS rating due to fatalities or severe injuries.

Table 2.2.T8, State Highway Crash Severity
Segments in Top 10% site in Safety Priority Indexing System (SPIS)

Segment	Property Damage Only	Severe Injury	Fatal
US 97 (The Dalles-California Hwy #4)			
MP 124.41 – 130.18	28	26	2
MP 143.47 – 150.71	30	22	2
MP 168.18 – 169.68	5	5	2
US 20 (McKenzie-Bend Hwy #17)			
MP 14.30 – 17.48			

Source: ODOT, Safety Priority Index System

Looking at the crash reports filed that formed the basis for Tables 2.2.T7 and 2.2.T8, several patterns emerge along with potential countermeasures. Many of the crashes involve winter weather, driver errors, and/or alcohol.

US 20 Crashes

MP 90.85 - MP 92.85 (approximately Deschutes/Jefferson County line to Black Butte Ranch): A majority of crashes were rear-end and fixed object collisions. Thirteen out of fifteen total crashes occurred on wet, snowy or icy roadway surface conditions. Weather advisory signs/message boards should be considered for this segment.

MP 5.30 - MP 9.72 (approximately Gist Road to Innes Market Road): Thirty out of forty-two total crashes occurred under dry conditions. Majority of crashes were rear-end, side-swipe and fixed objects. One head-on fatality crash occurred during dry daylight conditions. Errors in the crash reports included: followed too close, driving too fast, fatigued, careless driving, and inattention. Law enforcement and speed advisories should be considered for this segment. Raised barriers may also be considered to eliminate the potential head-on crash potential.

MP 4.80 - MP 9.16 (approximately Powell Butte Highway to Dodds Road): One-third of the total crashes were angle and fixed objects. Seventy five percent of crashes occurred during dry conditions. Drivers' errors included: driving too fast, following too close, and improper turning. Law enforcement and speed advisory should be considered for this segment.

OR 126 Crashes

OR126, MP 107.77 - MP 110.15 (approximately NW Oasis to SW 35th Street): The area is on the urban fringe of Redmond. Angle, turn, and rear-end collision formed the majority of crashes on this segment. They occurred during good weather with a dry roadway surface condition and at intersections and accesses. Consolidated accesses, channelized turn bays and raised median barriers should be considered for this segment.

OR 31 Crashes

OR31, MP 0.00 - MP 2.31 (approximately US 97 to Deschutes/Klamath County line): Four out of the seven total crashes were fixed object collisions. The majority of crashes were related to driving too fast and following too close. Law enforcement and speed advisories should be considered for this segment.

OR 242 Crashes

MP 77.14 - MP 91.11 (approximately Deschutes/Linn County line to McKinney Butte Road): The majority of crashes on this rural major collector occurred on wet and icy roadway conditions. Weather advisory signs/message boards should be considered although much of this segment is closed in winter at the snow gate at MP 83.71.

O'Neil Highway Crashes

MP 0.00 - MP 3.84 (approximately US 97 to NE 41st Street): Most of the nine total crashes involved driving too fast and alcohol. Law enforcement and speed advisory should be considered.

Century Drive Crashes

MP 8.43 - 21.98 (approximately USFS road to Tumalo Lake to Cascade Lakes Hwy): Of the 42 crashes, 21 were fixed object crashes. Thirty-six crashes occurred with wet, snowy or icy roadway surface conditions. Weather advisories should be considered for this segment.

Pavement Type/Condition

Out of the 832 roadway miles that the County maintains, 693 miles (83%) are paved while the other 139 miles (17%) are either dirt or aggregate. There is only one unpaved principal arterial in the County and that is OR 27 which runs north past Prineville Reservoir dead-ending in Prineville at OR 126. OR 27 is paved in Crook County and connects to US 20 approximately 30 miles east of Bend, between Millican and Brothers. There are no unpaved rural arterials, but several miles of unpaved rural collectors. The unpaved sections of collectors currently handle low daily traffic volumes and are identified in Figure 2.2.F15. The unpaved arterials/collectors are shown in Table 2.2.T9.

Table 2.2.T9

Unpaved Principal Arterials, Arterials, and Collectors

Classification	Road Segment	Miles	Average Daily Traf
Principal Arterial	OR 27: Crook Co – US 20	3.5	20
Collector	Buckhorn Rd: Lower Bridge Way – OR 126	4.2	166
Collector	Wilt Rd: Stardust Ln – End County maintenance	4.4	1,384
Collector	Rickard Rd: Blackfoot Trail – US 20	1.8	Unknown
Collector	Huntington Rd: N. Riverview to S. Riverview	2.2	Unknown
Collector	Foster Rd: La Pine State Rec Rd – S. Century	3.8	35
Collector	Masten Rd: Pavement's end – Klamath Co.	0.7	380

Source: Deschutes County Road Department

Road and Street Standards

Tables 2.2.T10-12 summarize the dimensional minimums for streets and roads in the unincorporated areas of Deschutes County. The standards attempt to balance accommodating through traffic on predominantly rural high-speed stretches vs. segments which traverse more quasi-urban areas. The unincorporated communities of Terrebonne and Tumalo have their own standards that were adopted in 1997.

At the time of the 1998 TSP, La Pine was an Urban Unincorporated Community and under County jurisdiction. Circa 1996 the County had established a planned area bounded by US 97, Huntington Road, 1st Street, and Burgess Road. Known as the New Neighborhood, the area was based on neo-traditional planning principles with road and sidewalk standards to match. Since November 2006, the City of La Pine has contracted with the County for current planning duties and the City has been using the previous County standards. The City is expected in the next few years to adopt its own TSP and have its own standards. As the County anticipates the City of La Pine will create its own standards, the road standards for the La Pine area are not summarized below as they were for Terrebonne and Tumalo.

The full minimum road standards for width, grade, design speed, etc., appear in Deschutes County Code DCC Chapter 17.48, Table A, Design and Construction Specifications. Table A is Appendix C in the TSP. This table includes the standards for those roads in the New Neighborhood in La Pine.

Bike facilities are covered in DCC Chapter 17.,48, Table B and are discussed below.

For State Highways, the dimensional standards shall be those adopted by ODOT and used in their project development process.

Table 2.2.T10

Minimum Road Design Standards, Rural County (Outside UGBs)

Type/Class	ROW	Paved Width	Travel Lane Width	Paved Shoulder Width	Gravel Shoulder Width	Turn Lane Width	Sidewalk Required
Rural Roads Outside of La Pine, Terrebonne and Tumalo							
State Hwy	80'-100'	36'-70'	12'	6'	---	14'	No
Rural Arterial	80'	28'-46'	11'	3'-5'	2'	14'	No
Rural Collector	60'	28'-46'	11'	3'-5'	2'	14'	No
Local Road	60'	20'-24'	---	---	2'	---	No
Industrial	60'	32'	---	---	---	---	No
Private	---	20'-28'	---	---	---	---	No
Frontage Road	40'-60'	28'	---	---	---	---	No

Source: DCC 17.48.050, Table A

Table 2.2.T11

Minimum Road Design Standards, Terrebonne Unincorporated Community

Type/Class		ROW	Paved Width	Travel Lane Width	Paved Shoulder Width	Gravel Shoulder Width	Turn Lane Width	Sidewalk Required
Principal Arterial								
US 97		80'-100'	60'	12'	6'	6'	14'	No*
Arterial								
Smith Rock Way	TeC	60'	34'	12'	5'	2'	14'	Yes
	TeR	60	34'	12'	5'	2'	14'	No
Lower Bridge Way		60'	34'	12'	5'	2'	14'	No
Collector								
Commercial	TeC	60'	24'	12'	---	2'	---	Yes
	TeR	60'	24'	12'	---	2'	---	No
Residential	TeR	60'	24'	12'	---	2'	---	No**
Local								
Commercial	TeC	60'	24'	12'	---	2'	---	Yes
	TeR	60'	24"	12'	---	2'	---	No
Residential	TeR	60'	20'	12'	---	2'	---	No***
Other								
Alley (Commercial)		20'	20'	10'	---	---	---	No
Path/Trail		15'	6'-8'	---	---	2.5****	---	---

Source: DCC 17.48.050, Table A

* 6-foot sidewalks are required on both sides of US 97 between South 11th Avenue and Central Avenue with improved pedestrian crossings at B Avenue/97 and C Avenue/97

** 5-foot sidewalks with drainage swales are required from West 19th to 15th Street on the south side of C Avenue

*** 5-foot curb sidewalks with drainage swales required along Terrebonne Community School frontage on B Avenue and 5th Street

**** If path/trail is paved

Table 2.2.T12

Minimum Road Design Standards, Tumalo Unincorporated Community

Type/Class	ROW	Paved Width	Travel Lane Width	Paved Shoulder Width	Gravel Shoulder Width	Turn Lane Width	Sidewalk Required
Principal Arterial							
US 20	80'-100'	60'	12'	4'	6'	14'	No
Arterial							
Cline Falls Hwy	80'	36'	12'	6'	2'	14'	Yes
Cook Avenue	80'	36'	12'	6'	2'	14'	Yes
Collector							
Commercial	60'	30'	11'	4'	2'	14'	Yes
Residential	60'	30'	11'	4'	2'	14'	No
Local							
Commercial	60'	20'	10'	---	2'	---	No*
Residential	60'	20'	10'	---	2'	---	No
Other							
Alley (Commercial)	20'	20'	---	---	---	---	No
Path/Trail	15'	6'-8'	---	---	2.5'**	---	No

Source: DCC 17.48.050, Table A

*5-foot curbless sidewalks on both sides for roads designated for sidewalks in Tumalo Comprehensive Plan Map D2.

** If path/trail is paved

Bridge Condition

The County Road Department maintains a list of the 120 bridges throughout Deschutes County and their weight limits. Many of the bridges are relatively new, constructed of reinforced concrete, and are able to withstand many years of use before repairs or replacement is necessary. However, some others are old flatbed railroad cars that were converted to bridges. The Oregon Department of Transportation (ODOT) assesses bridge condition for all bridges over twenty feet in length. The County checks all bridges less than twenty feet long. Often a driver might not even realize the vehicle is crossing what is considered a bridge. While the Deschutes or Little Deschutes rivers have obvious bridges, Central Oregon has numerous irrigation canals which must be crossed.

Replacement or major renovation projects are added to the Major Roads Capital Improvement Program each year by the Road Department as funding becomes available. Table 2.2.T13 identifies the bridge locations, cost to upgrade and whether they are posted for weight limits.

Bridge load ratings are related to not just weight, but also number of axles. Therefore, there is not one single amount for a bridge's load limit. For specific weight limits for various axle and trailer combinations, please contact the Deschutes County Road Department at (541) 388-6581.

Restrictions on freight movements can have a ripple effect on bridges. As an example, length restrictions on the O'Neil Highway means aggregate trucks delivering loads from western Crook County to Redmond divert onto Smith Rock Way. This re-routing from a State highway onto County roads has put a strain on bridges on Smith Rock Bridge (Bridge #218403), 33rd Street (Bridge #216903), and 17th Street (Bridge #228701).

Table 2.2.T13

Substandard County Bridges

Bridge Location	Cost to Replace	Weight Limit
NE 17th Street	$150,000	No
Cascade Lakes Hwy (Fall River)	$637,000	Yes
Gribbling Road	$225,000	Yes
Holmes Road	$150,000	Yes
Sisemore Road	$687,500	Yes
Tetherow Road	$1,582,500	Yes
Wilcox Avenue	$150,300	Yes

Source: Deschutes County Road Department

Bicycle Facilities

Deschutes County, particularly the western third of the County, is known for its cycling opportunities. Cycling ranges from professional and amateur racing to commercially organized groups to local riders out for either training or recreational rides. There are even a few hardy cycling commuters between Bend and Redmond. For riders who prefer pavement, the options include low-volume County roads with topography ranging from relatively flat to steep alpine passes. For riders who prefer dirt, there are numerous USFS and BLM gravel and/or roads as well as single-track trails through the Deschutes National Forest and the sagebrush and juniper of BLM lands.

The County, along with the four cities, has peddled the cycling market to potential tourists as well as citing cycling as an amenity for economic development. In 2008, Senator Ron Wyden (D-OR) formed a Central Oregon Recreational Assets Committee, which included Deschutes County Commissioner Tammy Baney, to look at how the area's cycling, hiking, and skiing could be used to promote Central Oregon. The group identified several critical cycling routes, culminating in the Three Sisters Scenic Byway, a series of loops centered on Bend, La Pine, Redmond, and Sisters. Many of these cycling goals were anticipated in prior County plans.

The 1979 Deschutes County Comprehensive Plan directed that

> **"The County shall develop and adopt a County-wide systems plan for bike paths (bikeways) and trails which provides access to various destinations in and between urban areas and rural service centers."**

The Deschutes County Bicycle Advisory Committee was formed in 1988 (pedestrian component added in 1996) to respond to this policy statement. In March 1992, the County adopted a Bicycle Master Plan as a resource element of the Deschutes County Year 2000 Comprehensive Plan. The Bicycle Master Plan provides recommendations for policies, classifications of bike facilities, location of bike facilities, bicycle parking and other transportation issues related to bike facilities. Bicycle facilities include bikeways, both paved and unpaved, and parking. Currently, bikeway design falls under the general design criteria section of the County's DCC Title 17 (Subdivision Ordinance). It states that:

1. Bikeways shall be designed in accordance with the current standards and guidelines of the State of Oregon Bicycle Master Plan, American Association of State Highway and transportation Officials (AASHTO) Guide for the Development of New Bicycle Facilities, and the Deschutes County Bicycle Master Plan.

2. All collectors and arterials shown on the County Transportation Plan map shall be constructed to include bikeways as defined by the Deschutes County Bicycle Master Plan.

3. If interim road standards are used, interim bikeways and/or walkways shall be provided. These interim facilities shall be adequate to serve bicyclists and pedestrians until the time of the road upgrade.

The most prominent element of the County bicycle system is its paved, on-road bikeways. The County and cities for several reasons have placed emphasis on these routes:

1. The existing system of improved County roads, totaling approximately 750 miles, generally provides the most efficient and safest route for bicycle commuters and recreational cyclists traveling to and from home, work, school, and shopping.

2. The state gas tax revenues are only available for bicycle lanes or paths constructed within public rights-of-way.

3. Maintenance is easier for public agencies as part of their normal road maintenance.

Paved Bikeways

Bicycles are legally classified as vehicles which may be ridden on most public roadways in Oregon. There are four basic types of paved bicycle facilities in Deschutes County:

- ***Shared Roadway -*** On a shared roadway facility, cyclists share the normal vehicle lanes with motorists. Shared roadway facilities are common on urban residential streets and on narrow rural roads. Shared roadways are acceptable on all streets, other than new construction of arterials and collectors. In places with significant bicycle travel, these roadways are signed as bicycle "routes."

- ***Shoulder Bikeway*** - Smooth, paved, rural roadway shoulders provide a good area where cyclists can ride with faster moving motor vehicle traffic with few conflicts. The majority of bicycle travel on the state highway system is accommodated on shoulder bikeways. Shoulder bikeways may be used on any uncurbed street section. A shoulder bikeway shall be provided on all new construction of uncurbed arterials and collectors. In places that bicycle travel is significant, these roadways can also be signed as bicycle "routes."

- ***Bike Lane -*** Where bicycle travel is substantial and where adequate width is available, a portion of the roadway may be designated for preferential use by cyclists. Bike lanes shall be provided on all new construction of urban collectors and arterials, and on rural road segments designated as bicycle "routes". Bike lanes are more common in urban rather than rural areas.

- ***Bike / Multi-Use Path -*** A bike path is a bikeway that is physically separated from motorized traffic by open space or a barrier. Bike paths may be located within the roadway right-of-way or within a dedicated bike path right-of-way. Bike paths are normally two-way facilities. Bike paths may be multi-use paths if sufficient width is provided. They generally serve corridors not served by other bikeways or pedestrian facilities and where there are few crossing roadways.

Unpaved Bikeways

With the advent of mountain bikes, previously unused trails and poor roads are opened up to potential use as inexpensive bike routes that require little more than right-of-way and signage. This has become even more possible with the improvements to mountain bikes in terms of their suspension. Deschutes County has many primitive roads and trails, most of which are on National Forest or Bureau of Land Management land, some of which are located close to urban areas. There are approximately 1,300 miles of forest highways and 450 miles of trails within the County, of which most are open to bicycles. The County controls about 500 miles of unimproved public rights-of-way.

Trails leading from southwest Bend to Benham Falls and along the Deschutes River to Sunriver are two examples of routes that offer enormous recreational potential. This is particularly true of USFS #41 Road between Century Drive and River Summit Drive (formerly USFS #40/#45 Road). The USFS has taken the lead in recognizing the growing popularity of mountain biking and has designated many trails and roads in the County for that use.

Cyclists have always used unpaved roads and paths (smooth and hard-packed) where paved routes were unavailable. Where their incorporation into the bikeway system is appropriate, they may be classified as shared, unpaved roadways or unpaved bike paths. With the advent and growing popularity of mountain bikes, even rough, unpaved routes have become popular bikeways, creating a new classification:

- ***Mountain Bike Trail/Route -*** This category is designed to accommodate bicycle travel on unpaved roads and trails. Mountain bike trails are primarily recreational, although in some cases they may provide an interim transportation facility. Mountain bike riding is intended to be as natural an experience as possible and any improvements beyond that absolutely required for safety may deter from this experience. Often mountain bike trails are combined with Nordic ski trails and with roadways that are otherwise closed to motorized vehicle traffic. Mountain bike trails generally are not shared with pack animals. Most often the only improvement needed to existing facilities is signing.

Alternative Routes

Typically, main bike routes are chosen because they are the most direct, desirable routes. These routes, however, often utilize the shoulders of state highways. The volume and speeds of the traffic as well as the mix of heavy vehicles can make it challenging to ride along the shoulders of state highways. Additionally, for valid safety reasons ODOT often scours the shoulders to make "rumble strips" as a countermeasure to inattentive drivers leaving the roadway. These can be harsh on bicycle wheels.

Alternate routes were identified in the Plan to enhance and supplement, rather than supersede the main routes. Alternate routes are usually the most cost effective or immediate way to provide for bicycle movement through a difficult section. As such, they may serve in a primary capacity until the main route can be improved for bicycle traffic. Several high traffic sections with bike facilities in the County have alternative routes identified in Table 2.2.T14 that were formerly considered "parallel bikeways."

Table 2.2.T14

Alternative Routes for Riders to Avoid State Highways

Bike Facility Location	High Traffic Area	Alternate Route
U.S. Highway 20	North of Bend	O.B. Riley Road
U.S. Highway 97	Sunriver Entrance to La Pine	South Century Drive and Huntington Road
U.S. Highway 97	Sunriver to Bend	Forest Service Road #41 (unpaved)
U.S. Highway 97	Bend to Redmond	Old Redmond-Bend Highway or Cline Falls Highway

Source: Deschutes County staff map analysis

Bikeway Maps

The existing and proposed bike facilities are shown in Chapter 5 at Figures 5.5.F2-F5.. These include the Three Sisters Scenic Bikeway and County roads that are popular with cyclists.

Typical Bikeway Design Standards

Table 2.2.T15 summarizes the major elements of the typical bike design standards currently used in Deschutes County. The complete minimum standards for bicycle facilities are found in DCC Chapter 17.48, Table B in Deschutes County Code.

Table 2.2.T15

Selected Minimum Bikeway Design Standards

Type	Stripe	On/ Off Road	Width			Vertical Clearance	Horizontal Clearance (ea. side)	Grade		ROW
Multiuse Path		Off	Min	Std	High Use	Min	Min	Std	Max	Min
			8'	10'	12'	8'	2'	5%	>5% up to 500'	15'
Mtn. Bike Trail		Off	n/a	2'	n/a	7'	n/a	n/a	n/a	n/a
Bike Lane	8" with painted stencil	On	4' w/open shoulder 5' w/curb or parking	6'				Use on URBAN arterial or major collector, or RURAL roads near urban areas with high anticipated bike use		
Shoulder Bikeway	4'	On	4'	4' w/ open shoulder 5' w/ curb or other barrier	6'			Recommended on higher speed and traffic volume rural roads		
Shared Road-way		On						Recommended only on local roads with speeds of 25 mph or less and <3,000 ADT		

Source: DCC 17.48.050, Table B

Bicycle and Pedestrian Facilities in Resort Communities

There are four resort communities in the County that have developed independent bicycle networks. These networks, being privately owned, funded and maintained, are available to owners and guests of the individual communities and are not open to the general public. However, these bike facilities shall meet County construction standards and shall not impede movement within the Countywide system.

- ***Sunriver -*** Sunriver is a large resort community located fifteen miles south of Bend and several miles west of US 97. Sunriver has a permanent population of approximately 1,300 people and a seasonally larger population of guests, vacationers and part-time residents. The Sunriver Owners Association owns approximately thirty (30) miles of paved off-road bicycle paths within the resort.

- ***Black Butte Ranch -*** Black Butte Ranch is a planned resort community located approximately ten miles west of Sisters off of US 20. The 1,830-acre community has a resident population of approximately 300 people and a seasonally larger population of guests, vacationers and part-time residents. BBR has approximately sixteen (16) miles of paved off-road bicycle paths.

- ***Eagle Crest Resort -*** Eagle Crest Resort is a 1,300-acre destination resort community of single-family homes and condominiums located approximately four miles southwest of Redmond. The current resident population is approximately 75 with an added 300 people as overnight or seasonal guests. Eagle Crest has approximately three to four miles of bicycle paths from six to eight feet wide.

- ***River Meadows Recreation Homes -*** River Meadows is a 160-acre private residential development located eight miles southwest of the Sunriver Resort on the Deschutes River. The development has approximately 1.5 miles of bicycle paths surrounding the development.

Pedestrian Sidewalks/Walkways

The majority of the roadways in Deschutes County are rural in nature and thus there is no requirement for sidewalks or other pedestrian accommodations. The exception is the unincorporated communities which have smaller lots and higher population densities. Thus in Terrebonne and Tumalo sidewalks are required for new development along certain arterials and collectors. Both of these communities are quasi-urban with a recognizable commercial core. The County also has sidewalk standards for La Pine, which was an Urban Unincorporated Community until November 2006. The County is under contract to do current planning for La Pine and will continue to require sidewalks until either La Pine established its own TSP and development code or ceases to contract with the County for current planning services.

The County standard for sidewalk width is five feet. Although most of the County's improved sidewalks occurred in La Pine when it was an Urban Unincorporated Community, the other two critical areas for sidewalks are Terrebonne and Tumalo. These two communities have schools and higher population densities than in the rural areas of the County. The existing and planned sidewalks are shown in Chapter 5 at Figures 5.5.F6 (Terrebonne) and F7 (Tumalo) highlight the sidewalk networks. In Terrebonne, there are extensive sidewalks along US 97 and 11th Street and B Smith Rock Way. In Tumalo, the sidewalks are concentrated along Cook Avenue and Fourth and a portion of Fifth. The rest of the rural areas of the County do not have sidewalks.

Public Transportation

The public transportation landscape has had several dramatic transformations since the 1998 TSP was adopted. Bend began a fixed-route transit service called Bend Area Transit (BAT) in 2006. The hub and spoke system is centered on Hawthorne Station, which is on Hawthorne between Third and Fourth streets. Hawthorne Station is an intermodal hub for several other public transportation providers in addition to Bend's fixed-route service. The Central Oregon Intergovernmental Council (COIC) through an Oregon Solutions grant developed a coordinated public transportation plan for Crook, Deschutes, and Jefferson counties.

The 2007 County plans were based on the concept of combining the transportation offerings of various public transportation providers such as social service agencies, public health agencies, and non-governmental groups. These groups provided transportation services to the elderly, disabled, and other

people without personal means of transportation. An outgrowth of COIC's work was the 2008 creation of Cascade East Transit (CET), which offered intercity service within the tri-county area. CET absorbed BAT in 2010. Figure 2.2.F16 displays CET's routes.

Cascades East Transit is Central Oregon's regional transit provider and offers the following services:

- Intra-community public demand response services in LaPine, Madras/Culver/Metolius, Prineville, Redmond/Terrebonne, and Sisters
- Intra-community public fixed route and complimentary paratransit services in Bend
- Inter-community Community Connector Shuttles connecting those communities with each other and with Warm Springs

CET began in Crook County and requested that COIC take over the operation of the Crook County Dial-A-Ride, a seniors-only transportation program for Prineville. At that time, there were several independent transit services in Central Oregon, operated by individual non-profits and social service providers. None of the services were coordinated, and there were no services available to the general public except in Bend.

In the next few years, COIC helped Crook, Deschutes and Jefferson counties develop their required Coordinated Human Services Transportation Plans. The plans identified a priority need for inter-community shuttles to connect transit dependent populations to employment and services within their communities. The plans also recognized a broader need for coordination and pooling of available transportation and social service transportation funding under one regional roof to enable greater efficiencies and increased service. Regional stakeholders also realized that general public transportation resources were available for Central Oregon but were not being utilized, and that they could be leveraged with local investment.

In October 2007, the Central Oregon Council on Aging entered into a MOU that transferred its buses and committed its senior transportation dollars (for senior buses in Sisters, Redmond, Madras, and La Pine) to COIC to create a regional transit system to better meet the needs of seniors in Central Oregon. COIC used this investment, plus investments from the Oregon Department of Human Services, the Partnership to End Poverty, Central Oregon Resources for Independent Living, the Opportunity Foundation, as well as many of the region's local governments, to leverage additional investment from state and federal sources.

In 2010 the City of Bend formed a transit advisory committee to look at whether it would be best for Bend to consolidate the City-operated Bend Area Transit (BAT) with the rest of the regional system. The committee recommended that the City move forward with developing an agreement with COIC to transfer BAT and consolidate it with CET, and the transfer occurred on September 1, 2010. Around that time, COIC also entered into an agreement with the Confederated Tribes of Warm Springs to add community connector service from Warm Springs to Madras, marking the first use of tribal transit funds in CET.

Significant efforts have occurred since then to consolidate the system and create a regional rider guide and fare stock to create the best experience for the public transit customer in Central Oregon. COIC opened Hawthorne Station in Bend on April 1, 2011, and will be improving the Redmond Transit Hub in summer 2011. These transit hubs provide better access and passenger connectivity.

Starting in August 2011, COIC will be developing a Regional Transit Master Plan, to be completed by December 2012, which will address the following:

- Short-term changes to transit services to better serve customers;
- Long-term goals for regional transit services;
- Long-term sustainable funding for transit services, tied to specific, high-priority service needs.

Deschutes National Forest (DNF) is currently conducting an "Alternative Transportation Feasibility Study" to develop a plan to reduce single-occupant vehicle (SOV) access to trailheads and other recreational assets. The DNF proposal would look at increasing the number of shuttles on Cascade Lakes Highway and outfitting those vehicles with bike racks and possibly trailer hitches. Deschutes County, ODOT, and CET are providing technical assistance.

In addition to regularly scheduled services, several transportation providers offer demand-response services. Commute Options also contracts with employers to provide vanpools and rider-match services for carpooling as well as transportation demand management (TDM) strategies.

Below is a list of providers of intercity transportation services by geographic links from Appendix C of the May 2009 *Deschutes County Coordinated Human Services Public Transportation Plan.*

Inter-City Public Transportation

Sisters to Bend
- Bend City Cab
- Cascade Shuttle
- Central Oregon Cabulance
- High Desert Wheelchair Transport
- Oregon Department of Human Services – Volunteer Services

Redmond to Bend
- Bend City Cab
- Cascade Shuttle
- Cascade East Transit
- Central Oregon Breeze
- Central Oregon Cabulance
- Green Energy Transportation
- High Desert Wheelchair Transport
- Oregon Department of Human Services – Volunteer Services

La Pine to Bend
- Bend City Cab
- Cascade Shuttle
- Cascade East Transit
- Central Cascade Lines
- COCOA, Dial-A-Ride
- Central Oregon Cabulance
- High Desert Wheelchair Transport
- Oregon Department of Human Services – Volunteer Services
- Sunriver Resort employee shuttle

Prineville to Bend
- Bend City Cab
- Cascade Shuttle
- Cascade East Transit (via Redmond)
- Central Oregon Breeze (via Redmond)
- Central Oregon Cabulance
- High Desert Wheelchair Transport
- Oregon Department of Human Services – Volunteer Services

Sisters to Redmond
- Black Butte Ranch employee shuttle
- Bend City Cab
- Cascade East Transit
- Cascade Shuttle
- Central Oregon Cabulance
- High Desert Wheelchair Transport
- Oregon Department of Human Services – Volunteer Services

Madras to Redmond
- Bend City Cab
- Cascade Shuttle
- Cascade East Transit
- Central Oregon Breeze
- Central Oregon Cabulance
- High Desert Wheelchair Transport
- Oregon Department of Human Services – Volunteer Services

Prineville to Redmond
- Bend City Cab
- Cascade Shuttle
- Cascade East Transit
- Central Oregon Breeze
- Central Oregon Cabulance
- Crook County Veterans' Transportation
- High Desert Wheelchair Transport

Additionally, there are public transportation providers with regularly scheduled services that stop in Deschutes County while connecting to the Oregon Coast, the Willamette Valley, and Eastern Oregon. (All times, routes, and locations are subject to change and should be verified by contacting the service provider.) Those providers include:

- **Central Oregon Breeze -** Bend to Portland with stops in Redmond (CET center and Redmond Airport) once a day, leaving Bend at 7 a.m. and returning at 6:00 p.m. On Fridays and Sundays there is a second bus leaving Bend at 11:30 a.m. and returning at 10:30 p.m.

- **Eastern POINT -** Provides daily service between Bend, Burns, and Ontario. The bus departs Hawthorne State at 2:45 p.m. Pacific Time arriving in Ontario at 9:05 p.m. Mountain Time. The bus leaves Ontario at 10:10 a.m. Mountain Time and arrives in Bend at 3 p.m. Pacific Time.

- **High Desert POINT -** Provides two daily vans from Redmond, Bend, and La Pine to Chemult, the latter being the depot for Amtrak rail passenger service. The morning van leaves the Redmond Airport at 7 a.m.; Hawthorne Station at 7:40 a.m.; Sunriver Lodge at 8:15 a.m.; and the La Pine Shell station at 8:40 a.m., arriving at Amtrak depot in Chemult at 9:20 a.m. The evening van leaves the Redmond Airport at 5:20 p.m.; Hawthorne Station at 6:05 p.m.; Sunriver Lodge at 6:35 p.m.; and the La Pine Shell station at 7 p.m., arriving in Chemult at 7:40 p.m.

  The inbound morning van leaves Chemult at 9:45 a.m., arriving in La Pine at 10:25 a.m.; Sunriver at 10:25; Bend's Hawthorne Station at 11:15 a.m., and Redmond Airport at 11:50 a.m. The inbound evening van leaves Chemult at 8:10 p.m.; La Pine at 8:50 p.m.; Sunriver at 9:15 p.m.; Bend's Hawthorne Station at 9:45 p.m. and Redmond Airport at 10:30 p.m.

- **The People Mover –** Grant County to Bend on Mondays, Wednesdays, and Fridays with a stop at Redmond Airport if requested. The van leaves Prairie City at 6 a.m. arriving at McDonalds on South 97 in Redmond at 9:55 a.m. and Bend's Hawthorne Station at 10:45 a.m. The return leg leaves Bend at 3:30 p.m. arriving at the Redmond south McDonald's at 4:20 p.m. and Prairie City at 8:20 p.m.

- **Porter Stage Lines –** Travels to Coos Bay via Eugene daily, leaving Bend at 3 p.m. and arriving at coast at 8 p.m. The return trip leaves Coos Bay at 9:20 a.m., arriving at Bend at 2:35 p.m. Currently, the Bend pick up/drop off point is Lava Lanes Bowling Alley, but this may change to Hawthorne Station.

- **Valley Retriever Bus Lines –** One daily bus operates between Bend, Albany, Corvallis, and Newport. The bus leaves Hawthorne Station at 10:55 a.m. and arrived in Newport at 4:10 p.m. The Bend-bound bus leaves Newport at 5:45 a.m. and arrives at Third Street and Hawthorne at 10:40 a.m.

Finally, Mount Bachelor operates a shuttle from Bend to the mountain which serves both the public and employees from the park and ride lot at Simpson/Colorado. The shuttle offers a reduced spring schedule.

Local Demand-Response Transportation Providers

Besides the fixed route services described above, several other organizations transport people to their destinations. These special transportation providers serve mainly the elderly and disabled populations or other similar niches rather than the general public. The organizations are a mix of public, private, and non-profit entities. Reservations are often required.

- **City of Bend Dial-A-Ride -** The City of Bend operates this service and a form of fixed-route/demand responsive system called a "scheduled route" for residents of the City of Bend and the urban area within approximately a three-mile radius of the City limits. This service is available to elderly residents aged 60 or above and disabled residents of any age. The demand responsive service operates from 8 a.m. to 8 p.m. on weekdays and 9:00 a.m. to 4:30 p.m. on weekends. The scheduled route service operates from 6:30 a.m. to 5 p.m. on weekdays only.

- **Central Oregon Council on Aging (COCOA) Dial-A-Ride -** Located in Redmond, the Central Oregon Council on Aging (COCOA) is a private non-profit agency that operates a demand responsive dial-a-ride system for senior citizens aged 60 and older and any disabled citizens. COCOA will transport the general public on a space-available basis. COCOA provides service outside the Bend urban area in the following locations:

- **La Pine -** The service area includes the Fall River area east of the Deschutes River, north to Vandevert Road, and south to include Jack Pine Village. Trips out of the service area to Bend are offered one day per week with a stop in Sunriver. Service is available four days per week in the La Pine area; service hours are 8 a.m. to 3 p.m. Monday, Tuesday, and Thursday, and 8 a.m. to 5 p.m. on Wednesdays.

- **Redmond -** The service area generally encompasses a three-mile radius of the City center five days per week and extends to a five-mile radius two days per week. Trips to Bend are offered two days per week via the Madras and Sisters dial-a-ride vans. Service is offered Monday through Friday in the Redmond area from 9 a.m. to 4 p.m.. A pre-scheduled shopper van is available Monday and Thursday.

- **Sisters -** The service area generally encompasses the vicinity of Sisters including the Cloverdale and Tollgate communities. Travel to Redmond is offered two days per week and to Bend one day per week. Service in Sisters is offered four days per week. The Redmond shopper van operates from 9 a.m. to 4 p.m. Monday and Thursday; the Bend van (via Redmond) runs from 9 a.m. to 3 p.m. on Wednesday, and local service is available Tuesday from 10 a.m. to 3 p.m.

- **Opportunity Foundation of Central Oregon -** The Opportunity Foundation of Central Oregon is a private non-profit agency that operates a demand responsive special transportation service to their program clients (70-100/day), primarily adults with disabilities. It has a residential and work center located in Redmond (and branch work center in Bend). Their service area is comprised of the Bend, Redmond, Terrebonne, and Tumalo areas in Deschutes County. Trip purposes include access to medical services, community resources, special events, recreation, home visits, competitions, and job sites. Service hours vary depending on community and work sites.

- **Residential Assistance Program (RAP) -** RAP is a private, non-profit organization that provides residential care and vocational training for developmentally disabled clients. Their service area is Deschutes County, but the five residential facilities are located in Bend, and the primary services are also located in Bend. Service is provided 24 hours per day (residential) but the vocational element is provided from 10 a.m. to 3 p.m. Monday through Friday.

- **Disabled American Veterans -** The Disabled American Veterans Chapter 14 in Bend operates a daily weekday shuttle to the VA Medical Center in Portland. This service is limited to any veteran needing transport to the medical center.

- **Volunteer Services -** The Oregon Department of Human Resources (DHR) Volunteer Services links DHR clients with volunteer drivers. Service hours are generally normal office hours Monday through Friday.

- **Central Oregon Resources for Independent Living (CORIL) -** CORIL is a private, non-profit organization that provides supported employment, recreational opportunities and independent living services. CORIL provides van transportation for its clients.

Transportation Demand Management (TDM)

Currently, the County, ODOT and the City of Bend jointly fund Commute Options for Central Oregon. This organization began in 1990 as a volunteer citizen's group working towards solutions to traffic congestion and pollution. They are responsible for maintaining the Central Oregon Rideshare list, promoting Commute Options Week each spring, and acting as transportation consultants to businesses, cities, counties and other agencies interested in alternative commuting methods such as carpooling, van pooling, shuttles, and teleworking as well as Safe Routes to School (SR2S).

Rideshare (Park & Ride) Facilities

This plan makes reference to *rideshare* lots, which are more appropriate for the carpooling emphasis in Deschutes County, rather than *park & ride* lots which usually involve a fixed route transit stop (such as the Mt. Bachelor Super Shuttle). In Deschutes County, there is a significant amount of intercity commuting as well as commuters who come from Crook County to Bend primarily, but also Redmond. Prior to the establishment of a public transit system a skeletal network of commuter rideshare lots developed. With a maturing CET system, these need for park and ride lots can be expected to increase.

The first officially designated lot is located in Wickiup Junction at the southwest corner of Highway 97 and Burgess Road. This lot is signed and paved, and has an average observed usage of approximately six to seven cars per day. Other pre-existing sites include one at the Deschutes County Services building at the south end of La Pine, on at Sunriver Marketplace another at Mini-Market in Terrebonne, one in Sisters near US 20/Locust, another in south Redmond, the Mount Bachelor SW Simpson and SW Colorado in Bend, one at ODOT's main campus near Third Street/Empire, and one on ODOT-owned property at the northwest quadrant of US 20/Powell Butte Highway. In general, Commute Options seeks locations that are sheltered or shelter is nearby, have access to convenience goods such as coffee, and have public visibility to ensure users feel comfortable and safe.

Staff has also observed what appear to be informal rideshare areas both in the North and South County with those in South County being near US 97. An example of these informal lots would be the northwest quadrant of US 97/Vandevert Road. These locations are generally used by five or fewer cars per day. Figure 2.2.F17 shows the location of the existing rideshare lots. It is likely that several informal lots exist within shopping center parking areas, movie theaters, or other similar locations.

Central Oregon Rideshare

Central Oregon Rideshare is a carpool matching service available to Deschutes, Crook and Jefferson County residents free of charge. The matching service is essentially a database of interested individuals which is maintained by Commute Options for Central Oregon. The program is a partnership between ODOT, the City of Bend, Deschutes County, the Oregon Department of Energy, OSU Extension Service and Commute Options for Central Oregon. Commute Options will debut an enhanced RideShare website in fall 2011.

Railroad

The lonesome whistle of the locomotive first sounded in Central Oregon in 1911, five years before Deschutes County was carved from Crook County. Competing railroads were drawn to Central Oregon for the region's timber resources. The rail lines are shown on F2.2.F18.

Passenger Rail

Other than the occasional excursion train from Portland to Bend, no regular passenger rail service is currently available in Deschutes County. The nearest scheduled passenger rail service available to Central Oregon residents is the Amtrak "Coast Starlight" train which runs one train each way once daily (weather permitting) between Los Angeles and Seattle. The station (platform) is in Chemult, located approximately 60 miles south of Bend along US 97. The City of Prineville Railway (CoPR) has run dinner trains periodically in the summer.

Freight Rail

The Burlington Northern Santa Fe (BNSF) Railway provides freight operations on a trunk line running through Deschutes County. This line connects with the Union Pacific main line at Biggs in the north and with the Union Pacific (UP) mainline at Chemult to the south. Through a haulage agreement, the UP can also send traffic down the BNSF tracks. The BNSF line usage varies between seasons and by fluctuations in fuel prices for the trucking industry. The line provides direct rail connections for shipping to markets in the U.S., Canada, and Mexico. Current usage on the BSNF mainline ranges from eight to 12 trains daily.

City of Prineville Railway (CoPR) provides shortline operations between the BNSF wye at Prineville Junction, which is three miles north of Redmond on the east side of US 97, and the City of Prineville as well as industrial lands in western Crook County. The 19-mile line carries one train a day.

Central Oregon Rail Plan (2009)

The Central Oregon Area Commission on Transportation (COACT) commissioned a study of rail issues in the tri-county area. The study's focus was on the effect of increasing numbers and lengths of trains through a north-south rail corridor and how that affected cities with major east-west roads that crossed the tracks at-grade. The study also looked at how to ensure rail freight mobility and how Central Oregon shippers can have access to BNSF and UP via CoPR. Finally, the BNSF expects to double-track their line through Central Oregon which has implications for increasing the time at-grade crossings would be closed to cross traffic.

At-grade crossings are dangerous for both motorists and railroad personnel. There are 41 public at-grade railway-roadway crossings on the BNSF mainline between La Pine and Madras. Nearly 50 percent of those are within the communities of Bend, La Pine, Madras and Redmond. The City of Prineville Railway has 15 mainline at-grade crossings with 33 percent of those within communities. There are also numerous private at-grade crossings. Over the past 10 years there have been 17 train/vehicle crashes resulting in 10 injuries and 4 deaths. With increased rail and vehicle traffic this is expected to substantially increase.

The Central Oregon Rail Plan looked at whether it was feasible to relocate the tracks to the east instead of upgrading existing urban intersections with overpasses or underpasses. The preliminary cost estimate (construction plus right-of-way) to relocate vs. upgrade existing crossings is provided below:

- Relocate BNSF mainline around both Bend and Redmond - $617 million
- Grade-separate existing crossings from south of Bend, north of Redmond - $386 million
- Relocate BNSF mainline around just Redmond - $176 million
- Grade-separate existing crossing in Redmond - $182 million

Besides costs, the two approaches differ markedly in the ability to phase the improvements. Regarding realigning the railroad, there is no benefit until the entire route is relocated whereas at-grade crossings can be upgraded one at a time for additive improvements to freight performance and crossing safety. The study determined the economics, environmental, and land use challenges were of such magnitude, that it was preferable to keep the railroad on its current alignment.

The study then examined the existing crossings for vehicle ADT, major issues, and cost estimates. The result was a prioritized list of which at-grade crossing would be improved or closed.

Of the 41 at-grade public crossing, seven were ranked as the highest priority to grade separate. Of those seven, two are within rural Deschutes County. The pair is BNSF/CoPR lines at Prineville Junction/O'Neil Highway and BNSF mainline/Baker Road. The Prineville Junction/O'Neil Highway, which is about three miles north of Redmond off of US 97, has a preliminary cost estimate of $18 million. The Baker Road crossing is to the west of US 97 at the southern edge of Bend. The preliminary cost estimate to grade separate this crossing was $36 million. The Baker crossing will require its own planning effort due to the complicating factors of proximity to on/off ramps to US 97, access to Deschutes River Woods Store, and several public intersections in close proximity.

While much of the at-grade crossing study focused on freight mobility, service, and safety, the plan did mention further research to determine the feasibility of passenger rail service in Central Oregon. The establishment of bus rapid transit (BRT) would be a logical precursor to passenger rail service.

Motor Freight/Trucking

U.S. Highways 97, 20 and OR 126 all carry intercity and interstate freight trucking. US 97 and US 20 are designated as Freight Routes in the Oregon Highway Plan.

Air Transportation

Aviation has a long history in Deschutes County with many airfields dating back to World War II as training fields due to the region's semi-arid climate. That tradition continues with flight schools for both fixed and rotary wing aircraft (i.e., planes, gliders, and helicopters) at the Bend Airport and a fixed-wing flight school in Redmond.

There are seven existing public-use airports in the County. Four of these airports have improved (paved) runways, and offer a range of services, from the availability of commercial passenger flights arriving and departing daily at Roberts Field in Redmond, to the Sisters (Eagle Air) Airport which offers no services or runway navigational aids. Figure 2.2.F19 shows the location of the four public-use airports in Deschutes County, while Figure 2.2.F20 identifies the locations of the private or "personal-use" airports in the County.

The County protects established airports from incompatible land uses or structures through DCC Chapter 18.76, Airport Development (A-D) Zone and DCC Chapter 18.80, Airport Safety (A-S) Combining Zone. The A-S zone was adopted in 2001 and the A-D zone was adopted in 2003.

The purpose of the AD zone is to allow for development compatible with ongoing airport use consistent with the Deschutes County Year 2000 Comprehensive Plan and the 1994 Bend Airport Master Plan (as amended by a 2002 supplement), while providing for public review of proposed development likely to have significant impact on surrounding lands. The AD Zone is composed of three separate zoning districts, each with its own set of allowed uses and distinct regulations, as further set forth in DCC Chapter 18.76. The City of Bend is currently updating the Bend Airport Master Plan with an expected completion in 2012.

The purpose of the AS zone is to restrict incompatible land uses and airspace obstructions around airports in an effort to maintain an airport's maximum benefit. The imaginary surfaces and zones; boundaries and their use limitations comprise the AS Zone. Any uses permitted outright or by conditional use in the underlying zone are allowed except as provided for in DCC 18.80.044, 18.80.050, 18.80.054, 18.80.056 and 18.80.058. The protection of each airport's imaginary surfaces is accomplished through the use of those land use controls deemed necessary to protect the community it serves. Incompatible uses may include the height of trees, buildings, structures or other items and uses that would be subject to frequent aircraft over-flight or might intrude into areas used by aircraft.

In any zone that is overlain by an A-S zone, the requirements and standards of DCC 18.80.010 shall apply in addition to those specified in the ordinance for the underlying zone. If a conflict in regulations or standards occurs, the more restrictive provisions shall govern.

The State of Oregon Aviation Plan (2007) classifies the State's 97 public airports into several categories based on types and frequency of operations, runway dimensions and other operational characteristics, commercial flights, types of aircraft, etc.

Category I – Commercial Service Airports

These airports support some level of scheduled commercial airline service in addition to a full range of general aviation aircraft. This includes both domestic and international destinations.

- Redmond Municipal Airport

Category II – Urban General Aviation Airports

These airports support all general aviation aircraft and accommodate corporate aviation activity, including business jets, helicopters, and other general aviation activity. These airports' primary users are business related and service a large geographic region or they experience high levels of general aviation activity.

- Bend Municipal Airport

Category III – Regional General Aviation Airports

These airports support most twin- and single-engine aircraft and may also accommodate occasional business jets. These airports support a regional transportation need.

- None in Deschutes County

Category IV – Local General Aviation Airports

These airports support primarily single-engine, general aviation aircraft, but are capable of accommodating smaller twin-engine general aviation aircraft. These airports support local air transportation needs and special use aviation activities.

- Sisters Eagle Air (private)
- Sunriver

Category V – RAES (Remote Access/Emergency Service) Airports

These airports support primarily single-engine, general aviation aircraft, special use aviation activities, and access to remote areas or provide emergency service access.

- None in Deschutes County

Public-Use Airports

Regional/Commercial Service

- ***Roberts Field-Redmond Municipal Airport (RDM) –*** Owned and operated by the City of Redmond for the tri-county area, the airport is located in the southeast corner of the City on OR 126 and east of Highway 97. RDM is the fourth-largest commercial service airport in Oregon serving all of Central Oregon. Commercial service is provided by Horizon Air (part of the Alaska Air Group); United, United Express and Delta Connection (provided by SkyWest Airlines); and Allegiant Air. These carriers offer approximately 46 arriving and departing flights daily with direct flights to Denver, Portland, Salt Lake City, San Francisco, and Seattle, and flights twice weekly to Las Vegas and Phoenix-Mesa.

  RDM also serves air cargo and general aviation traffic, including extensive corporate and business travel. Also based out of RDM are Butler Air, Lancair, and the U.S.D.A. Forest Service. Redmond also provides airfreight package express service via FedEx, AirPac (Airborne Express) and UPS Air. For planning purposes, the Redmond airport is classified as a small commercial service or business-class general aviation airport (SCSB).

  Annual enplanements (boardings) for the ten-year period between 2000 and 2010 are shown in Table 2.2T16. The average growth in boardings has been just over four percent per year for the last decade. Just as the current economic recession has led to lower volumes on highways and roads, the boardings from 2007-10 also declined overall by 1.3 percent.

  Redmond updated its Airport Master Plan in April 2005. The main feature from a rural transportation perspective is extending Runway 22 to the northeast for 1,500 feet then

necessitates realigning OR 126 to maintain the runway protection zone (RPZ) and other imaginary surfaces. (See Figure 4c from the Redmond Airport Master Plan.) The Plan anticipates the approximately $6-million extension will be implemented between 2015-2024.

Table 2.2.T16

Redmond Municipal Airport Boardings, 2000-2010

MONTH	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	10-Year Average Per Year	2007-10 Average Per Year
January	12,218	12,726	11,243	11,485	11,678	14,216	16,323	18,166	21,328	17,633	18,621	5.0	1.9
February	11,293	12,506	10,422	10,854	11,859	12,275	14,930	16,523	20,509	16,620	16,427	4.7	1.3
March	13,347	14,627	11,633	12,186	12,601	15,229	17,372	18,969	21,777	19,179	18,887	4.3	0.5
April	11,853	12,753	10,597	10,568	11,353	14,089	15,444	18,224	19,362	16,970	17,870	4.9	-0.3
May	12,966	13,672	11,264	11,530	11,799	15,535	16,126	20,103	20,391	17,578	18,451	4.5	-2.5
June	14,270	14,842	12,764	13,089	13,765	16,556	18,055	22,210	22,322	20,633	20,950	4.5	-1.8
July	15,114	16,137	13,410	13,559	14,082	18,509	18,821	23,856	23,354	22,583	22,879	5.1	-1.4
August	15,746	17,916	15,347	14,082	15,646	18,536	22,380	24,251	23,321	23,205	23,728	4.8	-0.7
September	13,967	9,794	12,545	12,255	13,355	16,408	19,002	20,542	18,743	19,374	19,475	4.7	-1.6
October	14,000	11,181	11,567	12,928	13,420	16,228	19,282	21,106	18,728	18,785	19,310	4.0	-2.7
November	13,231	11,003	11,039	11,852	13,239	14,238	18,347	20,292	17,835	18,790	19,016	4.4	-1.9
December	13,708	11,513	12,751	12,718	14,101	17,176	19,081	22,085	19,722	21,159	21,057	5.0	-1.3
TOTALS	**161,713**	**158,670**	**144,582**	**147,106**	**156,898**	**188,995**	**215,163**	**246,327**	**247,392**	**232,509**	**236,671**	**4.3**	**-1.3**

Source: City of Redmond Airport

Municipal

For planning purposes, the Bend and Sunriver airports are classified as medium size general aviation (MGA) airports due to runway dimensions and operational characteristics.

- ***Bend Municipal Airport -*** The Bend Municipal Airport is a public general aviation airport located 5.5 miles northeast of Bend on Powell Butte Highway. It provides charter flights, service, and rental cars.

- ***Sunriver Airport -*** The Sunriver Airport is a privately owned general aviation airport located at the Sunriver destination resort 15 miles south of Bend and several miles west of Highway 97. The airport is open to the public year-round offering fuel and service. Rental cars can be arranged as well as transportation to the Sunriver Lodge.

- ***Sisters Airport -*** Twenty miles northeast of Bend, the Sisters Airport is a privately owned, public-use general aviation airport abutting the City of Sisters on Camp Polk Road. The airport is open to the public, but no instrument navigation aids, fuel or services are available. The airport is unattended and supports locally based aircraft, but primarily accommodates recreation-oriented traffic. The airport has certain operational limitations, which are associated with runway orientation, prevailing winds, and high elevation terrain located approximately 2,000 feet northeast of Runway #2.

  In addition to the four public-use airports previously listed, the following airstrips are registered aviation facilities with ODOT Aeronautics as of December 1994. These facilities may or may not be currently in use. They are mostly private "personal use" airports and are in most cases no more than dirt landing strips.

Private-Use Airports and Heliports

• Cinder Butte HP	3.4 miles N of Redmond
• Cline Falls Airpark	6 miles W of Redmond
• D.M. Stevenson Ranch AP	4 miles S of Bend
• Deschutes County Sheriff's HP	2.7 miles N of Bend
• Fall River Fish Hatchery (DF&W) AP	31 miles SSW of Bend
• Freight Wagon Field AP	5 miles S of Redmond
• Gopher Gulch AP	3 miles NW of Bend
• Horseman HP	6.3 miles NW of Bend
• Inspiration AP	8 miles NE of Bend
• Juniper Air Park	10 miles SE of Bend
• Kennel Airstrip	7 miles E of Bend
• La Pine HP	S edge of La Pine
• Pilot Butte AP	S of Pilot Butte in City of Bend
• Pine Ridge Ranch AP	5 NE of Sisters
• Sage Ranch AP	9 miles SE of Sisters
• St. Charles Medical Center HP	Near 27th/Neff in City of Bend
• Sundance Meadows AP	6.5 miles SE of Bend
• The Citadel AP	9 miles NE of Sisters
• Whippet Field AP	6 miles NE of Sisters

Air Freight Service

Air freight is available at the Redmond Airport through United Express and Horizon Air. Express package services are provided by Federal Express (FedEx), Airborne, United Parcel Service (UPS), and the U.S. Postal Service Express Mail.

Waterborne Transportation

No commercial river transport services or port districts are located in Deschutes County, although there are numerous white-water rafting and flat water guiding companies.

Pipeline Transportation

The TransCanada Corporation (which acquired the Pacific Gas Transmission Company) operates two natural gas transmission lines from Canada to California that generally follow the US 97 corridor through Deschutes County.

2.3 Existing Land Use, Population and Employment

Analysis of Existing Land Uses and Vacant Lands

The combination of zoning regulations and proximity to the County's four cities and cities in adjoining Jefferson and Crook County all influence land consumption and travel patterns.

Based on a review of land use patterns, locations, densities and types of development, staff is able to analyze the current travel patterns in the County and the transportation needs of the residents. A key element in this analysis is the identification of all vacant developable land and currently platted parcels within the County. Developable land in the County occurs in several different land-use categories.

The focus of this chapter is the identification of the Unincorporated Communities, the MUA-10 and RR-10 zones (Exception Areas), and the other areas that also have some development potential. The location of these developable parcels and vacant land has a bearing on where future County residents will live and work.

Overall, the Oregon planning system is designed to guide economic development to within Urban Growth Boundaries with the exceptions of activities that predate the circa 1973 origin of the statewide land use program. Economic development on rural lands is oriented more toward certain natural resource activities (logging, mining, related processing, etc.) and destination resorts. None of the uses in Forest, MUA-10, or RR-10 are major potential traffic generators.

Current Land Use Patterns

Historically, Deschutes County has developed in a linear pattern along the main highways that traverse the western third of the County. The US 97 corridor from Terrebonne south to La Pine is the most developed, followed by the US 20 corridor between Sisters and Bend. Most of the development in the County is confined to a three-mile wide band along these two major highways. Bend, Sisters and Redmond have developed into regional nodes that provide goods and services for the larger geographic areas that surround them. These cities have urban growth boundaries (UGBs) which limit residential and commercial development to specific densities and locations. The County TSP addresses the areas outside of the UGBs. A much lighter development pattern is a series of nodes on US 20 in the eastern two-thirds of the County. Brothers, Millican, and Hampton once provided services to through travelers and area ranchers, but only Brothers has remained economically viable.

Unincorporated Communities (UC)

In 1994 the Land Conservation and Development Commission created a new Oregon Administrative Rule, 660-22, to define and regulate rural areas with pre-existing commercial, industrial, residential development as well as public uses. These were areas that contained pre-existing activities at intensities that were greater than typically found on rural lands. The intent was to support the Oregon land use system that promotes growth in urban areas while protecting rural lands for rural uses. The new unincorporated communities rule defined four types of unincorporated communities and required counties to review existing Rural Service Centers and similar areas for compliance with the new rule.

The four types of UCs attempted to distinguish between places that were almost small towns with main streets and adjoining neighborhoods from locales that might be as small as one or two buildings at a crossroads. The County maintains land use data on every property with special consideration devoted to the UCs because these are the only areas outside of UGBs that can develop commercial and industrial uses. From approximately 1997 to 2002 the County applied OAR 660-022 though a series of staff workshops and public hearings before the Planning Commission and the Board of County Commissioners. As a result there are 11 designated Unincorporated Communities (UUC) (Figure 2.3.F1 and Table 2.3.T1), under the following subcategories:

Urban Unincorporated Community	-	Sunriver
Rural Community	-	Terrebonne, Tumalo
Rural Service Center	-	Alfalfa, Brothers, Hampton, Millican, Wildhunt, and Whistlestop
Resort Community	-	Black Butte Ranch, Inn of the Seventh Mountain/Widgi Creek
Other Exception Areas	-	Rural Commercial: Deschutes Junction, Deschutes River Woods Store; Pine Forest, Rosland, and Spring River; Rural Industrial: Bend Auto Recyclers, Deschutes Junction, and Redmond Military Site

The number of lots includes legal properties within the UUC that are assigned a tax lot number. In some cases tax lots have been assigned to private roads, common areas, canal rights-of-way, traffic circles, etc. Development constraints mean lots where one or more of the following combinations of zoning may overlay the property: 100-year floodplain, Surface Mining Impact Area (SMIA), Wildlife Area (WA), and Landscape Management (LM). Terrebonne does not have any of these zoning code development constraints on vacant lands, which is why there is a zero in Table T2.3.T1, but there are issues with sewer and water which are described below.

The individual UCs vary in the extent of current development and degree of development potential. While there may appear mathematically to be a number of potential lots to develop, in actuality constraints such as topography, inability to accommodate new septic fields or sewer, lack of water, and distance from the region's cities limit the number of lots that would actually develop.

Table 2.3.T1 shows that Terrebonne and Tumalo are the rural communities that possess the most potential for regional impact from the development of new lots (mostly residential) in the County. Both are within easy commuting distance of larger cities (Terrebonne is three miles north of Redmond on US 97; Tumalo is six miles northwest of Bend on US 20). However, each has substantial constraints on development.

In Terrebonne the Community Plan (DCC 23.40.030, Ordinance 2010-012) indicates the two major constraints are topographic and sewer. Both are complicated by the small lots sizes (25 feet by 100 feet) in the Hillman subdivision. There is a large rim that angles through the community from northwest to southeast approximately between 19th Street and US 97 just north of F Avenue. There is also the remnant of a large barrow pit east of NW 19th Street and south of Lower Bridge Way. While Angus Acres and Terrebonne Estates Subdivisions rely on a community wastewater treatment plant, the remainder of Terrebonne's businesses and residents have on-site systems. Yet, certain areas near the Hillman Plat rest on the aforementioned rimrock, making onsite systems inoperable. The shallow soils, often no deeper than 18 inches, render a standard septic system infeasible. Alternative systems and advanced onsite treatment systems in these circumstances are necessary for building additions or new development.

Table 2.3.T1

Unincorporated Communities

Community	Total Existing Lots	Total Developed Lots	Vacant Lots	Vacant Lots With Development Constraints	Total Area (acres)
Alfalfa	7	4	3	0	20.32
Black Butte Ranch	1,2850	1,228	57	8	1,914.45
Brothers	6	4	2	2	50.32
Deschutes River Woods	2	1	1	1	4.99
Hampton	4	2	2	2	35.38
Inn of the 7th Mountain	654	548	106	104	317.06
Millican	1	1	0	0	29.5
Spring River	17	7	10	10	9.27
Sunriver	4,47	4,073	374	174	3,745.13
Terrebonne	793	555	238	0	791.76
Tumalo	329	209	120	120	585.51
Whistlestop	9	7	2	2	7.96
Wildhunt	5	4	1	1	11.29
Total	**7,559**	**6,643**	**916**	**424**	**7,522.94**

Source: Deschutes County Tax Assessor's Office

A few properties in Terrebonne also do not meet the requirements for an onsite system because they are too small, under a 0.5 acre or contain rapidly draining soils. As a result these tax lots cannot be developed or redeveloped. Deschutes County's Comprehensive Plan and zoning regulations restrict the type and intensity of allowed uses to those that can be served by an approved onsite wastewater treatment system. State and County zoning regulations set minimum lot sizes to ensure that onsite systems do not exceed the capacity of the land.

The Tumalo Community Plan (DCC 23.40.030, Ordinance 2010-027) shows Tumalo faces similar challenges of drainage fields and small lots in addition to the floodplain of the Deschutes River. The Laidlaw Addition, like the Hillman Plat in Terrebonne, has 25 foot by 100 foot lots. Unlike portions of Terrebonne, none of Tumalo has a community wastewater facility. Instead, land uses in Tumalo rely on onsite wastewater systems, ranging from newer alternative treatment technologies (ATT) and filter systems, to old drain fields. Onsite systems in some cases are insufficient and improper for a development site. According to the Deschutes County Environmental Health Division, most of Tumalo's soils are rapidly draining, with rapid or very rapid permeability. Given these soil characteristics, standard septic systems can only be sited on lots greater than an acre. Smaller lots, between a half acre and an acre are obligated to site more expensive onsite systems such as sand filters and ATTs.

Additionally, there are circumstances in Tumalo where certain lots cannot be developed or redeveloped because they are too small or lack sufficient area to meet setback requirements for septic system drain fields. Deschutes County zoning regulations restrict the type and intensity of allowed uses to those which can be served by an Oregon Department of Environmental Quality (DEQ) approved on-site

wastewater disposal system. The County does not allow uses or densities that are unable to obtain a permit for a DEQ approved onsite system. In addition, County zoning regulations set minimum lot sizes to ensure the onsite systems do not exceed soil capacity of treating wastewater effluent.

Trip Activity and Unincorporated Communities

The individual trip purposes of County residents were not identified in the 2030 Deschutes County land use/transportation model. However, studies in other areas have shown that the main sources of vehicle trips are journeys to work, school and shopping. The activity centers for the larger unincorporated communities (Sunriver, Terrebonne, and Tumalo) are mainly schools and local-serving retail. Additionally, Sunriver has numerous recreational amenities (bike paths, golf course, aquatic center, etc.) and proximity to the Deschutes River and Mount Bachelor. The fringe areas of urban growth boundaries (UGB) also attract trips from rural residents who rely on schools and services such as Alfalfa and Tumalo to Bend and Terrebonne to Redmond. Terrebonne experiences commuter traffic on US 97 and Lower Bridge Way from Crooked River Ranch (which is mainly in Crook County) bound primarily for Redmond or points farther south.

Terrebonne has a large array of goods and services (bank, grocer, gas station, several cafes, a school, etc.,) with Tumalo providing fewer goods and services (gas station and several eateries, a school) for their respective economic hinterlands. Sunriver also provides numerous goods and services for both visitors and South County in its mall; Sunriver also has an elementary school.

At the other end of the scale are places like Alfalfa or Brothers. These locales offer low-order goods such as convenience stores with gas stations and perhaps a single café. The Brothers Elementary School, a single-room schoolhouse, opens and closes depending on the school-age population of area ranches. The cafes and gas stations at Millican and Hampton continue to cycle in and out of business, reflecting their small population base, isolated locations, and low traffic volumes on US 20.

MUA-10 and RR-10 Exception Areas

The remaining unincorporated properties in the County, outside of UGBs and Unincorporated Communities, are either developed with low-density residential, recreational, or agricultural uses, or they are vacant.

Of the existing lots that can be developed, most are found in the Rural Residential 10-acre minimum (RR-10) and Multiple Use Agricultural 10-acre minimum (MUA-10) zones (Figure 2.3.F2). In 1979 the County identified lands that were not suitable for commercial farm or forest use. These lands are known as "exception areas" because they are excepted from Statewide Planning Goals 3 (Agriculture) and 4 (Forest).

In the state's land use continuum, Forest (F1 and F2) and Exclusive Farm Use (EFU) are almost solely intended for non-industrial, non-commercial, and non-residential uses. By County code definition the intent of the "F" zone is "to conserve forest lands" while EFU's purpose is "to preserve and maintain agricultural lands and to serve as a sanctuary for farm uses." By contrast, MUA-10 and RR-10 are intended to be a transition into less forest or agricultural uses, recognizing these lands provide for an orderly and efficient shift from rural to urban land uses. The EFU and Forest zones are shown at F2.3.F3.

County Code states the purpose of MUA-10 is "to preserve the rural character of various areas of the County while permitting development consistent with that character and with the capacity of the natural resources of the area" but preserving lands suited for "diversified or part-time agricultural uses" among other goals. The intent of RR-10 is to "provide rural residential living environments" consistent with "desired rural character and the capability of the land and natural resources" among other goals.

There are currently 24,481 tax lots in the MUA-10 and RR-10 zones, and of those, 6,696 (27%) are vacant. Based on GIS analysis, 3,341 (49.9%) of the existing vacant residential lots are less than one acre in size, and can still be developed (barring any other land use constraints) even though they now fall in a 10-acre minimum zone.

The location of the exception areas roughly corresponds to the Unincorporated Communities previously identified, but covers much more area. Table 2.3.T2 identifies the distribution of the existing MUA-10 and RR-10 lots in the exception areas throughout the County. The table indicates that most of the lots are located in the South County areas of Sunriver – South and La Pine - North. Based on the number of existing vacant lots in these two areas alone, the potential exists for the development of approximately 4,400 new residences in South County. However, many of the existing lots have development constraints (i.e., floodplain), and the actual development potential remains lower than the numbers indicate.

Currently, there are 112 existing 20+ acres, divisible tax lots in the County. If these lots were legally divided, they would create approximately 381new ten-acre lots.

Development Constraints

In Deschutes County, several types of overlay zones exist whose purpose it is to guide the location or siting of new development on particular properties in an effort to lessen the impact of that development. Examples of zones which could influence MUA-10 and RR-10 areas include:

- ***Flood Plain Zone (FP)*** – Seeks to protect the public from the hazards associated with flood plains; to conserve important riparian areas along rivers and streams for the maintenance of fish and wildlife resources; and to preserve significant scenic and natural resources while balancing the public interests with those of individual property owners in the designated areas.

- ***Landscape Management Combining Zone (LM) -*** to maintain scenic and natural resources of the designated areas and to maintain and enhance scenic vistas and natural landscapes as seen from designated roads, rivers and streams.

- ***Wildlife Area Combining Zone (WA)*** - to conserve important wildlife areas in Deschutes County; to protect an important environmental, social and economic element of the area; and to permit development compatible with the protection of the wildlife resource. Examples include deer winter range areas, significant elk habitat, and antelope range and deer migration corridors.

Table 2.3.T2

MUA-10, RR-10 Exception Areas

General Location	Total Existing Lots	Total Developed Lots	Vacant Lots	Vacant Lots With Development Constraints	Total Area (acres)
Bend - East	2,922	2,471	451	109	13,638.23
Bend – North/Tumalo	720	551	169	91	3,374.63
Deschutes River Woods	2,299	1,986	313	195	3,006.29
La Pine – North	6,241	4,295	1,946	1,946	9,961.65
Plainview	696	522	174	56	3,602.47
Redmond	612	455	157	97	3,638.16
Redmond – West	1,863	1,589	274	120	6,206.95
Sisters	2,050	1,588	462	237	7,923.87
Sunriver – South	5,080	2,662	2,418	2,418	6,087.32
Terrebonne	612	475	137	54	2,863.47
Tumalo	1,386	1,191	195	109	5,876.19
Total	**24,481**	**17,785**	**6,696**	**5,347**	**66,179.23**

Source: Deschutes County Tax Assessor's Office

- ***Surface Mining Impact Area Combining Zone (SMIA) -*** to protect the surface mining resources of Deschutes County from new development which conflicts with the removal and processing of a mineral and aggregate resource while allowing owners of property near a surface mining site reasonable use of their properties.

- ***Airport Height Combining Zone (AH) -*** to protect persons and property on the ground in the airport environs, as well as pilots using the airport facilities. This combining zone also seeks to preserve the function of public-use airports as increased development pressure around airports continues to threaten their existence.

The AH, FP, SMIA, and WA zones generally have the effect of guiding rather than precluding development. On the other hand, in some County locations, the issue of septic system feasibility does have the potential to limit development. Taken as a whole, the combination of existing vacant lots and potential new lots in UCs and MUA-10/RR-10 areas could have a localized impact on the function of the County's transportation system. Most of the 916 vacant lots in the UUCs and the 6,696 vacant lots in the exception areas lots are located in relatively compact corridors in the County. If even half of the 7,612 lots develop the resulting 36,423 daily trips (9.57 per single-family home according to the 8th edition of the Institute for Traffic Engineers manual) could require improvements to existing transportation facilities.

Other Development Areas

Outside of the RR-10 and MUA-10 zones, much of the remaining land in the County falls into the Exclusive Farm Use (EFU) or Forest Use (F) zones, and as such, should not develop with a significant amount of residential use. While there is development potential on the RR-10 and MUA-10 lands, the vast majority of County land, approximately 80 percent, still remains in public ownership (United States Forest Service, Bureau of Land Management, State of Oregon, Deschutes County), and therefore is unlikely to be developed during this planning horizon.

Another potential development area is the Rural Industrial (RI) and Surface Mining (SM) areas shown on Figure 2.3.F4. Even though these parcels are spread throughout the County, they do not amount to a significant amount of developable land. These parcels generally have the potential for localized impacts to the surrounding communities, rather than impacts to the region as a whole. Additionally, OAR 660-022, Unincorporated Communities, sets size limits on RI property to ensure the intensity does not approach urban levels.

Figure 2.3.F5 identifies the County lands that are currently zoned either Open Space (OS) or Flood Plain (FP). For all practical purposes, Open Space properties have minimal development potential, while Flood Plain areas will allow structural development with a Conditional Use Permit if an alternative location outside the flood plain is not available.

Population

Each year, The Center for Population Research and Census at Portland State University estimates population for each city and county in Oregon. Deschutes County reviews the draft estimates and adjusts the estimates according to local trends before the final numbers are released. The estimates of the 2005-2025 approved Coordinated Population Forecast (Ordinance 2004-012) for each incorporated city and the total County are shown in Table 2.3.T3. For planning purposes, the County and ODOT have used the base growth rate of 2005-2025 and extended it until 2030.

Historically, the U.S. Census has recorded Deschutes County population every decade since 1920. In fact, Deschutes County has been the fastest growing County in Oregon for many years. The percentage of people living in the unincorporated areas of the County has steadily decreased relative to the urban areas. Although Countywide population growth is expected to continue, the rate is expected to taper off as developable rural land is used up. Growth that will occur will be focused in the urban areas as they build out and slowly increase in density.

Table 2.3.T3

Deschutes County Population, 2005-2025

Deschutes County 2005-2025 Coordinated Population Forecast							
Year	**Bend UGB**	**La Pine UGB**	**Redmond UGB**	**Sisters UGB**	**Unincorp. County**	**Total County**	**Unincorp. % of Total County**
2000	52,800	n/a	15,505	975	47,320	116,600	41%
2005	69,004	n/a	19,249	1,768	53,032	143,053	37%
2010	81,242	1,697	23,897	2,306	57,430	166,572	34%
2015	91,158	1,892	29,667	2,694	64,032	189,443	34%
2020	100,646	2,110	36,831	3,166	71,392	214,145	33%
2025	109,389	2,352	45,724	3,747	79,599	240,811	33%
2030	119,009	2,623	51,733	4,426	88,748	266,539	33%

While the absolute number of people who live outside of a UGB will increase by 31,318 from 2010-2030 or roughly fifty-five (55) percent, the percentage of Deschutes County residents who live outside of a UGB will actually drop by one (1) percent over the same period as cities expand onto what were once County-zoned lands. The percentage share of total County population living on rural lands will decrease by eight (8) percent from 2000-2030. Since 2000 more people have lived in the City of Bend than the rest of Deschutes County's rural population. By 2030 the City of Redmond's population will be approximately 60 percent of the County's entire 2030 rural population.

In other words Deschutes County, despite its physical size, is increasingly an urban and not a rural county.

Employment

Employment data for Deschutes County were derived from the 2005-2009 American Community Survey (ACS). The ACS states there were 71,701 workers 16 years and older in Deschutes County. Approximately 48,265 or 67% percent are employed in the cities of Bend, La Pine, Redmond, or Sisters and 23,436 or 33% percent are employed outside of these cities.

In terms of rural employment the Economic Development for Central Oregon (EDCO) provides annual profiles of the tri-county area. In 2010 of the top 50 employers by number of workers, Sunriver was third (850 employees), Mount Bachelor was fifth (750 employees at peak of winter), Eagle Crest resort was 13th (342 employees) and Knife River was 20th (230 employees).

Taken together, the dispersed rural population and the employment numbers would indicate those living outside the UGB will still primarily commute to the four cities for work with a small amount traveling to adjacent counties.

Besides the number of jobs, the other critical factor is how workers get to their jobs. In Deschutes County the preferred mode is the single-occupant vehicle. Table 2.3.T4 shows the various modes commuters in the four cities and the unincorporated lands use to reach their jobs.

Table 2.3.T4

Commuting Choices by Mode

2005-2009 Journey to Work by Trip Mode										
	Bend		La Pine		Redmond		Sisters		Unincorporated	
Mode	Workers	%	Workers	%	Workers	%	Workers	%	Workers	%
Drove Alone	28,957	78.5	270	68.2	8,047	79.6	527	60.4	18,257	77.9
Carpooled	2,877	7.8	54	13.6	1,425	14.1	48	5.5	2,250	9.6
Public Transit	258	0.7	7	1.8	51	0.5	7	0.8	164	0.7
Walked	1,107	3.0	52	13.1	202	2.0	110	12.6	609	2.6
Biked	885	2.4	0	0	81	0.8	9	1.0	328	1.4
Other	184	0.5	13	3.3	40	0.4	43	4.9	164	0.7
Worked at Home	2,582	7.0	0	0	263	2.6	128	14.7	1,664	7.1
TOTAL	36,888	100.0	396	100	10,109	100	872	99.9	23,436	100

Source: US Census, American Community Survey, 2005-2009, Table S0801

For the rural lands outside of cities the data indicate driving alone is the overwhelmingly preferred method (77.9 percent). Interestingly, the next two-highest modes are carpooling (9.6 percent) and working at home (7.1 percent). This would indicate that park and ride lots and/or ride-sharing facilities are prudent investments as would be improvements to internet services that would enhance the ability to telecommute or telework. With the development of Cascades East Transit (CET), public transit (0.7 percent) may increase its share as commuters use one mode to reach the CET lots and continue their journey on CET vehicles. Walking (2.6 percent) and biking (1.4 percent) likely occur either on the edge of urban areas or within the unincorporated communities of Terrebonne and Tumalo. There is no officially designated worker housing at Eagle Crest, Mount Bachelor, or Sunriver, though some employees may live within these resorts/communities.

The data for commuting time is in Table 2.3.T5. It indicates congestion is not a problem for both urban and rural residents of Deschutes County. The national average for a commute is 25.5 minutes and the Oregon average is 22.2 minutes. Yet, nearly half (46 percent) of rural Deschutes County residents have a commute of 14 minutes or less. Roughly 20 percent of those living on rural lands have a commute of 15-19 minutes. This indicates how the bulk of the population on rural lands lives within close proximity to urban areas. (The total number of workers in each table is different because Table 2.3T6 does not include those who worked at home.) The relatively short commute times and the dispersed rural population could prove challenging to get a significant amount of rural commuters to change from driving alone.

Commute travel times have lengthened in Deschutes County. The 1990 Census under Journey to Work indicated 23% of workers in rural Deschutes County had a commute of less than 10 minutes vs. nearly 21% in 2005-2009.

Table 2.3.T5

Travel Times to Work

2005-2009 Travel Times to Work										
	Bend		La Pine		Redmond		Sisters		Unincorporated	
Minutes	Workers	%	Workers	%	Workers	%	Workers	%	Workers	%
<10	8,744	25.5	147	37.1	2,166	22.0	369	49.6	4,452	20.9
10-14	10,664	31.1	78	19.7	1,939	19.7	96	12.9	5,347	25.1
15-19	7,029	20.5	9	2.3	1,398	14.2	6	0.8	4,175	19.6
20-24	2,949	8.6	0	0.0	975	9.9	103	13.8	2,386	11.2
25-29	926	2.7	0	0.0	532	5.4	42	5.6	831	3.9
30-34	2,229	6.5	49	12.4	2,038	20.7	57	7.7	2,194	10.3
35-44	514	1.5	46	11.6	256	2.6	52	7.0	639	3.0
45-59	617	1.8	63	15.9	325	3.3	19	2.6	682	3.2
60>	617	1.8	4	1.0	217	2.2	0	0	596	2.8
TOTAL	34,290	100	396	100	9,845	100	744	100	21,303	100

Source: US Census, American Community Survey, 2005-2009, Table S0801

Macro commuting patterns for Central Oregon can be inferred from the commuting data regarding place of work as compared to place of residence. Table 2.3.T6 compares the three Central Oregon counties for numbers of people who work outside the county of their residence. While Deschutes County has a modest export of commuters, Crook and Jefferson send a much higher percentage of commuters to other counties with corresponding increases in commute times. In terms of population distribution and travel times, workers traveling between Prineville-Bend (30 miles), Madras-Redmond (26 miles), and Madras-Prineville (29 miles) will have travel times of greater than 30 minutes. Madras-Bend (42 miles) is likely being done by a hardy few.

Obviously, not every commute of more than 30 minutes is traveling outside of its home county. For instance the Deschutes County datum is complicated by the La Pine-Bend (32 miles) relationship. While 10.3% of Deschutes County workers have a commute of 30-34 minutes, a significant percentage of those are likely intracounty commutes between La Pine-Bend. Yet, overall, a commute of greater than 30 minutes is highly likely to cross county boundaries.

Redmond-Prineville (19 miles) means a commute in the 20-24 minute range would cross a county boundary, but with that one exception a commute time of 20-24 minutes would normally stay within the home county.

Table 2.3.T6

Export of County Workers

Commuting Patterns Outside of Home County and Travel Time by Percentage			
Workers	**Crook**	**Deschutes**	**Jefferson**
Commuters Who Work Outside Their County of Residence	27.1	4.4	22.2
30-34 minute commute	9.2	10.3	6.0
35-44 minute commute	5.0	3.0	4.4
45-59 minute commute	10.0	3.2	7.6
60+ minute commute	5.0	2.8	5.8

Source: US Census, American Community Survey, 2005-2009, Table S0801

In terms of affected highways and roads within Deschutes County, the trans-county commuters would be using US 97 (Madras-Redmond; Madras-Bend) and OR 126-Powell Butte Highway (Prineville-Bend). The short intercounty commute (Prineville-Redmond) would use OR 126. Outside of Deschutes County pairings, the main affected route would be US 26 (Madras-Prineville).

Finally, a varying number of Deschutes County residents work outside the city in which they live. Table T.2.3.T7 displays the percentages of the four cities' residents who work in their place of residence, outside of their home cities but still in Deschutes County, and outside of Deschutes County but within Oregon.

Table 2.3.T7

Deschutes County Residents' Places of Work

2005-2009 Where County Residents Work										
	Bend		La Pine		Redmond		Sisters		Unincorporated	
Place	Workers	%	Workers	%	Workers	%	Workers	%	Workers	%
Total Workers	36,888	100.0	396	100.0	10,109	100.0	872	100.0	23,436	100.0
Oregon	36,445	98.8	396	100.0	10,089	99.8	853	97.8	22,170	94.6
Deschutes County	35,671	96.7	388	98.0	9,250	91.5	842	96.6	20,237	90.2
In Place of Residence	30,875	83.7	32	8.1	5,095	50.4	548	62.8	n/a	n/a
Outside Place of Residence, but in Des. Co.	5,238	14.2	356	89.9	4,185	41.4	313	35.9	n/a	n/a
Outside of Des. Co.	775	2.1	8	2.0	829	8.2	11	1.3	1,031	4.4

Source: US Census, American Community Survey, 2005-2009, Table S0801

As the data indicate, Bend has the least amount of residents who leave to work in other cities in Deschutes County (14.2 percent) whereas almost 90 percent of La Pine's denizens leave La Pine and more than 40 percent of Redmond's residents leave to work in other Deschutes County cities. Sisters has nearly 36 percent of its residents leaving the city to work elsewhere in the County.

For this city-city commuting, the primarily affected facilities are State highways due to a lack of parallel local roads. La Pine-Bend is US 97; Sisters-Bend is US 20; Sisters-Redmond is OR 126; Redmond-Bend is US 97. Out of all these pairings, only Redmond-Bend has an alternate route (Old Bend-Redmond Highway) to the State highway. La Pine-Bend could use Huntington Road up to Sunriver but then would need to use US 97.

In terms of rural residents, 90.2 percent remain within Deschutes County while 4.4 percent commute to workplaces outside of the County.

CHAPTER THREE

Transportation Forecast

3.1 General Background

At the broadest scale, the travel forecast attempts to look at the interaction between land use attractors, population generators, and the linkages between the two. Travel forecasting generally starts by looking at the types of land uses allowed under zoning, the amount and distribution of population and assumptions about how different types of modes (bus, bike, drive alone or carpool, etc.,) people will use. These data are then converted into future vehicle or person trips for a set number of years. Trips are assigned to the roads and highways based on expected travel times. All of this data and information indicate how the transportation network will perform at the end of the planning horizon year and whether there are any resulting deficiencies.

In most urbanized areas, the transportation modeling process is done with computer programs that can be highly refined to deal with small geographic areas. Within Deschutes County, both Bend and Redmond have benefited from the use of computer modeling to forecast future road volumes. In those places, the urban areas could be divided into small, multi-block areas known as *traffic analysis zones*. In simple terms, once the traffic analysis zones or "TAZs" are identified, the computer assigns trips to those zones based on whether an individual zone has more trip *attractions* (employment, retail, school, etc.) or *productions* (residential). Finally, the computer identifies the expected traffic volumes on the affected streets.

Previously, traffic generators for areas outside of cities utilized two broad approaches. The simpler of the two techniques is using a "trending" alternative to project historical traffic growth trends out towards some future year. In trending, you look as far backward as you're going to project forward, assuming the percentage growth will remain at its historic rate. In other words, if traffic volumes grew at 3% per year for 1990-2010, then they will grow at 3% per year for 2010-2030. The other, "cumulative analysis" alternative, involves the use of existing traffic, historical growth rates, population, employment and dwelling unit forecasts, and the location of likely future growth, to project traffic.

For the Deschutes County Transportation System Plan (TSP) update, the Transportation Planning and Analysis Unit (TPAU) at the Oregon Department of Transportation (ODOT) developed the first transportation-land use model for the rural sections of an Oregon county. This is a hybrid of both approaches which also factors in time spent traveling between attractors and generators when modeling route choices. TPAU worked with County staff on amount of built and vacant lands by zoning, factored in unbuildable lots, looked at present and future development patterns, populations, employment, distance to destinations, and capacity of the road network. The model also contained two simplifying land use assumptions:

1. The future population and employment allocations for Bend, Redmond and Sisters are assumed as given in their models.
2. It is assumed that there will be no increase in employment outside of the urban model areas except in destination resorts.

The land use model divided the areas outside urban models into approximately 260 TAZ's. The model also accounts for the development of recreational and second homes in destination resorts and elsewhere in the study area; these were assumed to be about 13.7 percent of the total future households in the study area. The Deschutes County land use model also makes general allocations of

households and employment to Crook and Jefferson counties. The transportation model includes those areas in order to provide better traffic predictions at the Deschutes County boundary. These counties are also important to the allocation of recreational and second home development since Deschutes County is part of the overall Central Oregon market for these types of developments. However, the forecasts are not made at the geographic level of detail of places within Deschutes County as the model focuses on the aggregate picture. Further details on the model are included in Technical Memo #3, *2030 Future Traffic Conditions* which is included as Appendix B to the TSP.

3.2 Traffic Forecast

The year 2030 traffic projections are used as a planning tool to help test the ability of existing roadways to accommodate 2030 Annual Average Daily Traffic (AADT). The capacity of a roadway depends on a myriad of factors. These include number of lanes, access points per mile, and percent of truck traffic.

A higher number of access points means less capacity due to vehicles slowing to turn off of the roadway or entering the roadway and needing to accelerate to the prevailing speed, slowing traffic behind them. Trucks have lower acceleration rates, longer stopping distance, which means they begin to slow sooner on the mainline, and are more affected by hills and curves. The effects of access points and truck traffic are exacerbated on two-lane roadways as trailing vehicles often have no options other than to slow, which creates a ripple effect.

ODOT used its land use model to generate 30 different population and employment forecast distributions (scenarios) for 2030. These were then placed into the 2030 Deschutes County travel demand model to look at the effect on various highway, arterial, and collector segments. TPAU recorded the change for each link under each of the scenarios. Most links had no more than a ten (10) percent coefficient of variation, except for a few roads with extremely low Average Daily Traffic (ADT) volumes that were not major parts of the TSP network. (The coefficient of variation measures the range of data points from the mean. The lower the coefficient, the less dispersion there is in the measured variable.) Minor shifts in traffic volumes on roads with low AADT results in significant changes from a percentage standpoint, but not from an absolute numbers perspective.) No matter which of the 30 population and employment scenarios were used, the resulting traffic volumes were essentially the same on the studied links.

The resulting forecast volumes can then be used to determine whether the roadway meets the performance standards of either ODOT for State highways or Deschutes County for arterials and collectors. ODOT uses a volume/capacity (V/C) ratio as its measurement while Deschutes County uses time delay know as Level of Service (LOS). The standards apply to both roadway segments and intersections. Where State and County facilities intersect, ODOT's mobility standard prevails.

State highway segments were ranked based on a range of the mobility standards between 0.60 and 0.80 (based on engineering judgment) and the risk of exceeding the applicable mobility standard:

- v/c < or = 0.60: Low risk
- 0.60 < v/c < 0.80: Medium risk
- v/c > or = 0.80: High risk

The County's operational standard for an existing road is LOS D, which is between 5,700 and 9,600 ADT. Roadway segments under the Deschutes County jurisdiction were classified as:

- Below LOS D threshold: Low risk
- Within LOS D: Medium risk
- Above LOS D: High risk.

ODOT's Preliminary Signal Warrant (PSW) was used as a surrogate to evaluate unsignalized intersections. Meeting the AADT warrant only meant the side streets would experience significant delay in entering or crossing the main road. Given the rural location of the majority of these intersections, a traffic signal would not actually be the solution as drivers in high-speed rural areas do not expect them.

Due to the sensitivity of the model volumes and the normal fluctuations in volumes, the following warrant thresholds to rank intersection deficiencies were used:

- Between 60% and 80% of threshold: Low risk
- Between 80% and 100% of threshold: Medium risk
- Greater than 100% of threshold: High risk

As levels of delay increase on a side street, the concern is drivers will begin to become frustrated or impatient. Drivers may then attempt to pull onto or cross the highway, accepting gaps in traffic on the mainline that are too small to safely make the desired move. Accepting an insufficient gap in high-speed rural traffic can lead to increased crashes.

Future Traffic Conditions

The 2030 model results show the majority of future congestion will occur on the State highway system. While a highway may have adequate capacity in 2030, the higher volumes could still require more aggressive access management to prevent such crashes as head-ons and those related to turning on/off the highway. (Access management is a method to improve a road's performance by limiting the number of connections to the road, setting the spacing between connections based on a road's classification, or restricting turn movements into/out of a roadway.) A few short segments of County roads on the margins of urban areas will experience congestion as will a handful of County-County road intersections which are primarily in the Bend area.

Deschutes County Roads

Segments

Of the arterials and collectors studied in the County, the analysis indicates there are only a few segments that exceed the LOS D standard of 9,600 ADT. The 15 segments are primarily concentrated in the west edge of Redmond (11 segments), the southern and eastern edges of Bend (two segments), and just west of La Pine (two segments). Table 3.2.T1 lists the County road segments and their volumes in 2030.

The highest ADT segments in the County are in the Redmond area. These volumes reflect increasing congestion on both US 97 and OR 126 within the City of Redmond. Drivers will divert to Helmholtz Way as an alternate way to get south to 61st Avenue to then access US 97. The 2009 volumes of Helmholtz, which never crack 3,000 ADT even just north of OR 126, will by 2030 have skyrocketed to

19,700 ADT just north of the highway, an increase of 557 percent. Similarly, Helmholtz at SW Canal has a 1,965 ADT (2008) which by 2030 becomes 14,200 ADT, an increase of 623 percent. The other Redmond-area County road that will see dramatic growth is Northwest Way. In 2009 Northwest Way at Maple has 2,224 ADT whereas in 2030 the ADT there becomes 10,800, an increase of 386 percent.

The County road with the highest ADT in the Bend area is Baker Road between Apache Road and Cinder Butte Road at the southern end of Bend. This segment leads from US 97 into the Deschutes River Woods subdivision. The Baker Road interchange is the southernmost interchange in Bend and thus would serve both residents of Bend and those commuting to/from Sunriver and La Pine. The ADT increases from 6,174 (2009) to 11,100, an increase of 80 percent. Deschutes Market Road in NE Bend serves as a parallel local route to US 97, especially for those with destinations east of 15th Street. The traffic increases from 5,592 (2009) to 10,600, an increase of 90 percent. The model assumes Cooley Road has been extended from 18th Street east to Deschutes Market Road. If this does not happen, then

Table 3.2.T1
Deschutes County Roads and 2030 Levels of Service

Road	From	To	Ranking	AADT	LOS	Classification
Helmholtz Way	OR 126	0.25 mi N of OR 126	High	19,700	F	Rural Collector
Northwest Way	Maple Ave	0.5 mi N of Maple Ave	High	17,500	F	Rural Collector
Helmholtz Way	0.25 mi N of Wickiup Ave	OR 126	High	17,000	F	Rural Collector
Canal Boulevard	61st St/ Quarry Ave.	Helmholtz Way	High	16,500	F	Rural Collector
Helmholtz Way	Coyote Ave.	0.25 mi N of Wickiup Ave	High	14,700	E	Rural Collector
Helmholtz Way	Canal Blvd.	Elkhorn Ave	High	14,200	E	Rural Collector
Helmholtz Way	0.25 mi N of OR 126	0.25 mi N of Antler Ave	High	14,000	E	Rural Collector
Helmholtz Way	0.25 mi N of Antler Ave	Maple Avenue	High	12,000	E	Rural Collector
Cline Falls Hwy	Nutcracker Dr.	SW ramps of OR 126)	High	11,900	E	Rural Arterial
Helmholtz Way	Elkhorn Ave.	Coyote Ave	High	11,400	E	Rural Collector
Burgess Rd.	Meadow Ln.	Huntington Rd	High	11,200	E	Urban Collector
Baker Rd.	Apache Rd.	Cinder Butte Road	High	11,100	E	Urban Collector
Northwest Way	0.5 miles N of Maple Ave	Upas Ave	High	10,800	E	Rural Collector
Deschutes Market Road	Hamehook Rd.	Margaret Lane	High	10,600	E	Rural Collector
Burgess Rd	Day Rd.	Meadow Ln	High	9,800	E	Urban Collector

Road	From	To	Ranking	AADT	LOS	Classification
Lower Bridge Way	43rd St	31st St	Medium	8,800	D	Rural Collector
S. Century Dr.	Spring River Rd.	Abbott Road	Medium	8,700	D	Rural Collector
Powell Butte Highway	Butler Market Rd.	McGrath Road	Medium	8,400	D	Rural Arterial
OB Riley Rd	Old Bend Redmond Hwy	Destiny Ct	Medium	8,000	D	Rural Collector
Canal Boulevard	Elkhorn Ave	39th St	Medium	7,800	D	Urban Arterial
Powell Butte Highway	US 20	Neff Rd/Alfalfa Market Rd	Medium	7,800	D	Rural Arterial
Powell Butte Highway	McGrath Road	Morrill Rd	Medium	7,600	D	Rural Arterial
Baker Rd.	US 97 NB ramps	Scale House Road	Medium	7,100	D	Urban Arterial
Cline Falls Hwy	Cook Ave.	Tumalo Road	Medium	7,100	D	Rural Arterial
S. Century Dr.	Lazy River Dr.	Vandevert Rd	Medium	7,100	D	Rural Collector
Cook Ave	OB Riley Rd.	Cline Falls Hwy	Medium	7,000	D	Rural Arterial
Old Bend Redmond Hwy.	OB Riley Rd.	US 20	Medium	6,900	D	Rural Collector
Knott Rd.	Scale House Rd.	China Hat Rd	Medium	6,800	D	Urban Arterial
Cline Falls Hwy	Coopers Hawk Dr/ Falcon Crest Dr	Nutcracker Dr	Medium	6,700	D	Rural Arterial
Powell Butte Highway	Morrill Rd	County Line	Medium	6,700	D	Rural Arterial
Butler Market Rd .	Hamehook Rd	Silver Rd.	Medium	6,600	D	Rural Collector
Lower Bridge Way	31st St	US 97	Medium	6,600	D	Rural Collector
Powell Butte Highway	Neff Rd/Alfalfa Market Rd	Butler Market Rd.	Medium	6,400	D	Rural Arterial
Butler Market Rd.	Silver Rd	Powell Butte Hwy	Medium	6,200	D	Rural Collector
Deschutes Market Rd.	Margaret Lane	Dale Rd	Medium	6,200	D	Rural Collector
Burgess Rd.	Antler Lane	US 97	Medium	6,000	D	Urban Collector
Northwest Way	Coyner Ave.	Montgomery Ave	Medium	6,000	D	Rural Collector
Neff Road	Glacier Ridge Road	Hamby Road	Medium	5,800	D	Urban Arterial
Spring Riv. Rd.	Solar Dr.	S, Century Dr.	Medium	5,700	D	Rural Arterial

volumes will still increase, just by not as large of an amount. The model also assumes the City's Juniper Ridge lands that are currently outside the Bend UGB retain their rural zoning. Any UGB amendment and subsequent rezoning for Juniper Ridge would require the City to conduct a traffic study to identify the effects and needed mitigations.

In the La Pine area, the only County road that fails is Burgess. The two segments extend from Day Road to Meadow Lane and Meadow Lane to Huntington Road. The Day Road-Meadow Lane segment has an ADT of 3,098 (2008) which becomes 9,800 ADT in 2030, an increase of 216 percent. Meadow Lane to Huntington had 7,922 (2009) which grows by 41 percent to 11,200 ADT. Burgess Road not only leads east to US 97, but also west to the Deschutes River, Wickiup Reservoir, and the Cascade Lakes Highway as Burgess becomes USFS Road #42.

Intersections

The County sets a standard of LOS D for intersections, which means delays in p.m. peak (4-6 p.m.) on the side street do not exceed 35 seconds on average per vehicle at an unsignalized intersection and less than 55 seconds on average per vehicle at signalized intersections. (Because a traffic signal provides drivers the assurance that ultimately they will able to make their intended maneuver, they will accept more delay than at an unsignalized intersection.) Of the 16 intersections countywide that are classified as needing improvement in 2030, five are county-county connections. Table 3.2.T2 lists the County roads only intersections ranked as high (needing improvement) and medium. The intersections ranked as medium in 2030 do not need improvements, but are at levels of delay sufficient to encourage they be monitored.

Table 3.2.T2

Deschutes County Intersections in 2030

County Intersections That Need Improvements		
Location	**Ranking**	**Entry AADT**
Canal Boulevard/SW Helmholtz Way	High	16,918
Powell Butte Hwy/Neff-Alfalfa Market	High	10,829
Powell Butte Hwy/Butler Market	High	10,385
Deschutes Market/Hamehook	High	10,208
South Century/Spring River Road	High	10,026
County Intersections That *Do Not* Need Improvements		
Old Bend Redmond Hwy/O.B. Riley	Medium	9,859
Butler Market/Hamehook	Medium	8,533
South Century/Vandevert	Medium	8,410
Northwest Way/Coyner	Medium	7,617

State Highways

Segments

The analysis indicates there are extensive segments that will exceed ODOT's mobility standards in 2030. ODOT uses a Volume/Capacity (V/C) ratio for highway segments. The applicable V/C can vary depending on functional classification, Freight Route or Expressway overlay, and whether the highway segment is on rural lands or in an unincorporated community. Table 3.2.T3 lists the state highway segments by V/C.

Of the 25 segments listed as high and needing increased capacity, a dozen are on US 97, seven are on US 20, five are on OR 126, and one is on the O'Neil Highway. The US 97 segments are concentrated in the Terrebonne-Redmond area and Sunriver to La Pine. The current STIP has projects already programmed on US 97 for Galloway Avenue to Pershall/O'Neil Highway and the southbound off ramps at Cottonwood.

For US 20, the segments are found between Black Butte-Sisters, the Tumalo area, and Bend to the Powell Butte Highway. ODOT is in the late stages of preparing a refinement plan for the long-term solution for US 20 in Tumalo.

Table. 3.2.T3

State Highway Segments and 2030 Volume/Capacity

State Highway Segments That Fail						
Highway	**From**	**To**	**# Directional Lanes**	**AADT**	**V/C Ratio**	**Ranking**
US 97	11th Ave. (South)	Galloway Ave	1	25,100	1.19	High
US 97	SB Off Ramp at Cottonwood Road	So. Century Dr	1*	23,200	1.19	High
US 97	C Ave	0.08 mi N of 11th Ave (South)	1	247,00	1.18	High
OR 126	Quail Tree Dr	2 mi east of Quail Tree Dr	1	7,300	1.18	High
US 97	Galloway Ave	Pershall Way/O'Neil Hwy	1*	24,400	1.15	High
US 97	0.08 mi N of 11th Ave (South)	11th Ave (South)	1	23,400	1.10	High
US 97	E Ave	C Ave	1	21,800	1.08	High
US 97	Lower Bridge Way/11th St (North)	E Ave	1	22,700	1.07	High
OR 126	NW Helmholtz Way	35th St	1	21,000	1.03	High
US 20	Bailey Road/7th St	0.76 mi S of OB Riley Road	1	19,200	1.03	High
US 20	Hawks Beard	Tollgate	1	9,900	1.03	High
US 97	So. Century Dr	Vandevert Road	1	19,100	1.02	High
OR 126	Cline Falls Hwy Ramps	NW Helmholtz Way	1	18,900	1.00	High
US 20	Tollgate	Rail Way	1	11,900	0.98	High
US 20	Providence Dr	0.35 mi W of Hamby Road	1	15,900	0.97	High
OR 126	Sherman Road	0.73 mi E of Sherman Road	1	16,900	0.97	High
US 97	Wimp Way	Lower Bridge Way/11th St (North)	1	17,600	0.95	High
US 97	Vandevert Road	LaPine State Recrea-tion/Fish Hook Rd	1	16,400	0.95	High
OR 126	0.73 mi E of Sherman Road	County Line (1.30 mi E of Sherman Road)	1	16,600	0.95	High

State Highway Segments That Fail						
Highway	**From**	**To**	**# Directional Lanes**	**AADT**	**V/C Ratio**	**Ranking**
O'Neil Hwy	Yucca Avenue	NE 5th St	1	3,000	0.94	High
US 20	Gerking Market Road	Bailey Road/7th St	1	15,600	0.9	High
US 97	Pine Crest Lane	Drafter Road	1	15,100	0.87	High
US 97	LaPine State Recreation/Fish Hook Rd	Pine Crest Lane	1	14,400	0.86	High
US 20	0.35 mi W of Hamby Road	Hamby Road	1	12,400	0.83	High
US 20	Couch Market Road	Gerking Market Road	1	13,800	0.82	High
State Highway Segments That Meet Standards						
US 20	0.67 mi E of Tweed Road	Couch Market Road	1	12,500	0.77	Medium
US 97	6th Street	OR 31	1	12,200	0.76	Medium
US 20	Fryrear Road	Tweed Road	1	12,400	0.76	Medium
US 20	Hamby Road	Powell Butte Hwy	1	10,700	0.74	Medium
US 20	Cloverdale Road	Gist/Cloverdale Road	1	11,700	0.71	Medium
US 20	Gist/Cloverdale Rd.	Plainview Road	1	10,000	0.70	Medium
US 97	Bowery Lane	Grandview Drive	2	50,500	0.69	Medium
OR 126	Camp Polk Road	Cloverdale Road	1	7,700	0.68	Medium
US 20	Desperado Trail	Cloverdale Road	1	8,700	0.68	Medium
US 20	Plainview Road	Fryrear Road	1	11,200	0.68	Medium
US 97	Deschutes Pleasant Ridge	0.45 mi N Fort Thompson Ln	2	46,300	0.67	Medium
US 20	Jeff/Des County Line (0.02 mi N. of McAllister Rd.)	McAllister Rd.	1	5,500	0.67	Medium
US 20	McAllister Rd.	Hawks Beard	1	6,800	0.67	Medium
US 97	OR 31	Masten Road	1	9,500	0.65	Medium
US 97	Masten Road	Klam/Des County Line (0.9 mi South of Jackpine Loop)	1	8,200	0.64	Medium
OR 126	Creekside Court	Camp Polk Road	1	6,700	0.64	Medium
OR 126	101st Street	Oasis Drive	1	7,700	0.64	Medium
OR 126	Cloverdale Road	Quail Tree Drive	1	7,200	0.63	Medium
OR 126	2 mi east of Quail Tree Drive	Buckhorn/Barr Road	1	7,300	0.63	Medium
US 97	0.45 mi north of Ft. Thompson Lane	Bowery Lane	2	45,200	0.62	Medium
OR 126	Oasis Drive	Cline Falls Highway Ramps	1	8,400	0.62	Medium

State Highway Segments That Meet Standards						
US 97	Redmond City Limits	Deschutes Pleasant Ridge	2	32,150	0.44	Low
US 97	Bend City Limits	Baker Road Interchange	2	30,400	0.41	Low

*Being improved by current ODOT construction project

Regarding the five segments on OR 126, four are split between the west and east side edges of Redmond.

State highways are principal arterials that accommodate larger volumes of high-speed rural traffic than are found on County roads. Even if a highway segment is functioning at an acceptable V/C ratio, ODOT may adopt access management measures to lessen the exposure of the traveling public to crashes. Thus, besides adding travel lanes or improving the road's physical geometry, managing direct access to a state highway can improve a facility's performance as well as providing a safety benefit. Numerous studies have shown that as the density of access increases, whether public or private, the traffic carrying capacity of the roadway decreases and the vehicular crash rate increases.

Additionally, ODOT in the Oregon Highway Plan (OHP) at Policy 3B calls for raised medians when ADT exceeds 28,000 vehicles as a countermeasure to prevent certain types of crashes, primarily head-ons as well as broadsides from turning movements. Several multilane portions of US 97 will exceed that threshold, while remaining at adequate through capacity.

Intersections

When an ODOT highway and County road intersect ODOT's V/C ratio is the controlling performance standard. Table 3.2.T4 identifies intersections involving either State highway to State highway intersections or State highway to County road intersections; these are ranked as high (needing improvement) or medium, which means delays are of sufficient length that the intersection should be monitored.

Table 3.2.T4

State Highway Intersection Rankings in 2030

Intersections That Will Need Improvement		
Location	**Ranking**	**Entry ADT**
OR 126/Helmholtz Way	High	38,992
US 20/Old Bend-Redmond Hwy	High	28,639
US 97/O'Neil Hwy-Pershall Way	High	28,168
US 20/Cook Ave-O B Riley Rd	High	23,474
US 97 / Lower Bridge Way	High	23,465
US 97 / Vandevert Rd	High	19,772
US 97 SB On & Off Ramp / Baker Rd	High	13,476
US 20/Hamby Rd	High	12,978
US 20/Powell Butte Hwy	High	12,648
US 97/OR 31	High	12,250
US 97 NB Off Ramp/Baker Rd	High	11,148
Intersections That Will Need Monitoring, But Not Improvement		
US 97 / Smith Rock Way	Medium	25,437
US 20/ Cloverdale Rd	Medium	11,064

CHAPTER FOUR

TRANSPORTATION NEEDS ANALYSIS

4.1 General Overview

Three overall sources contributed to identifying the needs on the County's transportation system: 1) input from the general public; 2) outputs from the Deschutes County 2030 transportation-land use model, and 3) contact with technical staff from the Oregon Department of Transportation (ODOT) Region 4 and the cities of Bend, La Pine, Redmond, and Sisters. All three were blended together to indicate the County's future transportation needs regardless of mode or road authority. Staff also conducted workshops with the Deschutes County Planning Commission and the Board of County Commissioners; both bodies provided helpful suggestions for the Transportation System Plan (TSP).

The public contributed comments via several forums. The County held three rounds of open houses in multiple locations to listen to public concerns. The first round, called kick off meetings, were to alert the public about what a TSP is, provide a general timeline for the TSP's preparation, and most importantly solicit the public for its view on what the critical transportation issues were in their area. The September 2008 kick off meetings were held in Bend, La Pine, Redmond, Sisters, Terrebonne, and Tumalo. Based on attendance at the first round, staff returned in May 2010 for a second round of open houses where staff explained the results of Technical Memo #2 (Existing Conditions) and Technical Memo #3 (2030 Forecast Traffic Volumes). The second open houses were held in Bend, La Pine, Sisters, and Terrebonne. The final round of open houses occurred in June 2011 and staff presented the results of Technical Memo #4 (Mitigations Alternatives) in Bend, La Pine, Sisters, and Terrebonne. All three rounds featured a presentation with a question and answer format.

Additionally, transportation was a key topic in several other high profile planning projects conducted simultaneously with the development of this new TSP. Specifically, other Planning Division projects included the development of the Terrebonne Community Plan, the Tumalo Community Plan, the land use-transportation policies for the Deschutes Junction portion of the Comprehensive Plan Update, the proposal to add a 19th Street connection on the east side US 97 between Redmond and Deschutes Market Road, and updating the County's destination resorts procedures ordinance and overlay map of eligible properties. All of these planning efforts, which each took several years, featured multiple public meetings and stakeholder committee meetings as well as public hearings before the Planning Commission and the Board of County Commissioners.

Staff from County Planning Division, the Road Department, and ODOT Region 4 reviewed the existing conditions of County roads and State highways for deficiencies identified either by existing databases or local knowledge. The results of that research resulted in Chapter 2.2 "Existing Transportation System and Current Needs."

The results of the 2030 Deschutes County land use-transportation model revealed highway and roadway segments and intersections that exceed or nearly exceed either State or County performance standards. Those results are the backbone of Chapter 3.2, "Traffic Forecast."

By combining public input, State and County databases, staff technical knowledge, and results from the traffic modeling, the following general items were identified:

- High accident locations
- County arterial and collector capacity problems
- State highway capacity problems
- Desire for highway bypasses
- Desire for improved bicycle accommodations
- Desire for recreational trails
- Interest in expanded transit service
- Interest in passenger rail

Although presented as overall themes in the list above, Countywide issues and geographically specific sites are discussed in more detail below along with a response to the issue.

4.2 Public Involvement and Interagency Coordination

Goal 1of the Oregon land use planning system is Citizen Involvement. The Transportation Planning Rule (TPR) also requires coordination between public agencies at the federal, state, and local levels as well as special districts and private providers of transportation services. In developing the Deschutes County TSP Update, staff held open houses, met with various community groups such as the La Pine Transportation Advisory Group (TAG), Tumalo Community Association (TCA), and Central Oregon Area Commission on Transportation (COACT), Bend Metropolitan Planning Organization (MPO) Technical Advisory Committee (TAC), Deschutes County Bicycle and Pedestrian Advisory Committee (BPAC), and had numerous phone and e-mail contacts with the general public and peers at Bend, Bend MPO, La Pine, Redmond, and Sisters in addition to ODOT Region 4. Staff also held public work sessions and public hearings with the Deschutes County Planning Commission and Board of County Commissioners.

During the development of this update project, local broadcast, print media presented several stories on the TSP. A local blog dedicated to bicycle issues, BikeAroundBend, also did multiple entries on the TSP.

Interagency coordination was achieved by the formation of a Technical Advisory Committee (TAC), which held intermittent meetings for the duration of the project. Representatives on the TAC included staff from the County Planning Division and Road Department, ODOT Region 4, and the cities of Bend, La Pine, Redmond, and Sisters. A Steering Committee (SC) comprised of representatives of the County Planning Division and the Road Department as well as ODOT Region 4 met irregularly during the project. Instead of monthly gatherings, the committees tended to meet on an as-needed basis.

Similarly, staff briefed the Planning Commission and Board of County Commissioners as major milestones were reached. Examples of such milestones include reporting results of kick off meetings or completion of technical memos, or completion of the Deschutes County land use-transportation model.

Table 4.2.T1 provides a summary of various major meetings. These major meetings either concerned projects, policies, or solicited public input on issues that directly related to the TSP Update. Staff has not included every meeting the transportation planner has attended in the last three years, even though it may seem like that to the reader. Examples of omitted meetings are those related to the transportation system and the Bend UGB proposal; various Bend MPO TAC meetings; South Redmond Collaborative Group meetings; Central Oregon Area Commission on Transportation (COACT) and other similar standing meetings.

Table 4.2.T1

Partial List of Meetings Related to TSP Update

Event	Activity	Date
Commute Options meeting	Discuss future park and ride lots	July 9, 2008
Work Session with Board	General discussion	July 23, 2008
Steering Committee	Meeting #1	August 12, 2008
Technical Advisory Committee	Meeting #l	August 13, 2008
Central Oregon Builders Assoc. mtg	General Q&A on TSP update	September 2, 2008
TSP Kick Off Public Meeting, Tumalo	General Q&A, receive public input	September 2, 2008
TSP Kick Off Public Meeting, Bend	General Q&A, receive public input	September 4, 2008
TSP Kick Off Public Meeting, Sisters	General Q&A, receive public input	September 9, 2008
TSP Kick Off Public Meeting, Terrebonne	General Q&A, receive public input	September 17,2008
TSP Kick Off Public Meeting, Redmond	General Q&A, receive public input	September 18, 2008
Citizens from Sen. Wyden's Central Oregon Recreation Assets Committee	Discussed non-highway biking options between Bend-Sisters and Bend-Sunriver	October 1, 2008
Road Dept., Crook Co. Roadmaster, ODOT meeting	Actions needed to lift restrictions on Smith Rock Way, O'Neil Hwy,	October 1, 2008
ODOT citizen focus group	Issues on US 20 in Tumalo	November 9, 2008
Aggregate haulers, Road Dept., ODOT, Crook County, COID	Discuss short and long term fixes to Smith Rock Way, O'Neil Hwy, including piping canal under SRW	November 9, 2008
Comprehensive Plan	Terrebonne listening session	November 13, 2008
COIC, service providers	Coordinating Des Co Public Transportation Services and TSP	December 17, 2008
Work session with Board	Destination resorts and transportation	January 5, 2009
Bend MPO, TSP stakeholders group	Discussed traffic modeling	January 13, 2009
Work session with Board	Destination resorts and transportation	January 28, 2009
Commute Options	Expanding park and ride lots	January 29, 2009
Tumalo Community group	Discuss US 20	February 3, 2009
COIC, Commute Options, CET	Transit and park and ride lots	February 5, 2009
Terrebonne citizens group	US 97 issues, transit	February 5, 2009
Deschutes Junction citizens group	Discuss land use, transportation	February 17, 2009
Steering Committee	Meeting #2	February 17, 2009
ODOT 97/20 Project	Effect on County roads	March 1, 2009
COACT Rail	At-grade BNSF crossings	March 10, 2009
La Pine Transportation Advisory Group	General issues	March 19, 2009
Workshop with Des Co Planning Comm.	General overview of TSP process	March 26, 2009
Sen. Wyden's Central Oregon Recreation Assets Committee	Bike/ped issues and paving USFS #41 between Bend and Sunriver	April 6, 2009
ODOT Advisory Committee mtg	Review US 20 in Tumalo	April 7, 2009
ODOT, DLCD meeting	Discuss transportation and land use policies in Terrebonne, Des Jct	April 7, 2009
Technical Advisory Committee	Meeting #3	April 13, 2009
COACT Rail technical committee	At-grade BSNSF crossings	April 14, 2009
Steering Committee	Meeting #3	April 22, 2009
Pinewood Estates Homeowners Assoc.	Redesignate South Shawnee Circle from collector to local	April 23, 2009
ODOT Steering Committee	US 20 in Tumalo	May 7, 2009
Des. Co. Bike/Ped Advisory Committee	Bike/ped issues between Bend-SR	May 7, 2009
ODOT advisory committee	US 20 in Tumalo	May 12, 2009

Event (con't)	Activity (con't)	Date (con't)
Redmond technical advisory committee	Analyze regional transit service; fixed route service in Redmond	May 13, 2009
ODOT project team	Redmond Re-Route Phase II and Quarry Road interchange	June 2, 2009
COACT Rail TAC, SC meetings	Discuss at-grade crossings	June 9, 2009
Central Oregon Realtors Assoc.	General TSP Q&A	June 17, 2009
La Pine Transportation Advisory Group	General South County issues	June 18, 209
Deschutes National Forest	Reducing single-occupant vehicle usage to access recreation sites	June 30, 2009
ODOT project team	US 97/20 and County roads	July 6, 2009
La Pine City Council, County Board	TSP work session	July 7, 2009
COACT Rail TAC	At-grade vs. relocation	July 14, 2009
Sen. Wyden Central Oregon Recreational Assets group	Threes Sisters Scenic Bikeway and County roads	July 14, 2009
South Redmond Collaborative Group	Redmond Re-Route Phase II	August 4, 2009
COACT Rail TAC	At-grade vs. relocation	August 11, 2009
Public workshop on US 20 in Tumalo	ODOT public meeting on short-term solutions	August 11, 2009
Board work session	Financing and County roads	August 12, 2009
Board work session	Bend Airport Master Plan	August 19, 2009
Des. Co. BPAC meeting	Review County bike system	September 3, 2009
Board work session	Update on TSP	September 9, 2009
ODOT, Prineville Railway meeting	Discuss O'Neil Junction	September 10, 2009
Deschutes Junction stakeholders meeting	Review transportation and land use	September 16, 2009
Tumalo Steering Committee meeting	Discuss County roads and US 20	September 29, 2009
Terrebonne Community Plan meeting	Public input on US 97, County roads issues and options	October 19, 2009
Tumalo Community Plan meeting	Public input on US 20, County roads issues and options	October 20, 2009
Board work session	Debriefed Board on TSP, community plans	October 21, 2009
Board work session	Foster Road as part of County-maintained system	October 28, 2009
BPAC meeting	County roads and cycling	November 5, 2009
Citizens group meeting	Concerns about O'Neil Junction zoning and infrastructure	November 17, 2009
Citizens group meetings	Concerns about Gopher Gulch and OB Riley Road intersection	November 23, 2009
ODOT Project Team meeting	US 20 in Tumalo	November 30, 2009
Terrebonne Community Plan	Hear land use, transportation concerns on US 97	December 14, 2009
Deschutes Junction community meeting	Hear land use, transportation concerns on US 97	December 15, 2009
Public hearing before PC on PA-09-02	Add 19th Street to TSP map	December 17, 2009
Work session with Sisters City Council	Discussed general TSP issues	January 7, 2010
ODOT Tumalo Citizens Committee	US 20 in Tumalo	January 12, 2010
Board work session	Skyliners and other bike issues	January 25, 2010
Technical Advisory Committee	Meeting #4	January 26, 2010
ODOT Project Team meeting	Redmond Re-Route, Phase II	January 26, 2010
Bend Parks and Rec, Road Dept. meeting	Site visit for Tumalo Trail	January 28, 2010
PC deliberations on PA-09-02	Add 19th Street to TSP map	January 28, 2010

Event (con't)	Activity (con't)	Date (con't)
Terrebonne Community Plan meeting	Public input on draft plan	February 8, 2010
Board work session	TSP tech memos	February 10, 2010
TSP Steering Committee	Meeting #4	February 16, 2010
Board Public Hearing on PA-09-2	Add 19th Street to TSP	February 22, 2010
Deschutes Junction stakeholders meeting	Discuss transportation and land use	February 24, 2010
Board work session	Skyliners Road bike policies	March 3, 2010
Tumalo stakeholders	Discuss US 20	March 3, 2010
ODOT, High Desert Museum meeting	HDM's future access to US 97	March 8, 2010
Deschutes Junction residents meeting	Discuss frontage road on W of 97	March 9, 2010
Board work session	Bike parking policies	March 10, 2010
PC work session	Add ODOT's v/c to County code	March 11, 2010
Deschutes Junction subdivision residents	Hear concerns about transportation and land use	March 29, 2010
PC hearing on TA-09-2	Add v/c to County code	April 8, 2010
Board deliberations on PA-09-2	Add 19th Street to TSP map	April 19, 2010
Board work session	SDC's and destination resorts	April 21, 2010
Deschutes National Forest	Assess transit opportunities	April 29, 2010
TSP Open House #2, Sisters	Show 2030 forecasts, get feedback	May 3, 2010
TSP Open House #2, Terrebonne	Show 2030 forecasts, get feedback	May 4, 2010
TSP Open House #2, Bend	Show 2030 forecasts, get feedback	May 5, 2010
Board work session on TA-09-2	Add v/c to County code	May 12, 2010
PC work session	2030 forecasts; recap public input	May 13, 2010
Board work session	SDC's and destination resorts	May 20, 2010
Met with City of Sisters staff	Coordinate bike issues and routes	June 9, 2010
Met with City of Bend staff	Bend Airport Master Plan Update	July 26, 2010
ODOT Steering Team	Redmond Re-Route, Phase II	July 27, 2010
Open house on Pleasant Ridge/97 closing	Listen to public feedback	July 29, 2010
COIC meeting	Expanding regional transit	August 12, 2010
ODOT, Road Dept. mtg on TSP projects	Identify solutions to 2030 deficiencies	August 18, 2010
PC hearing on TA-10-6	Deschutes Junction policies	August 26, 2010
BPAC meeting	Show proposed TSP bikeways	September 2, 2010
Board work session	Proposed Tumalo Trail	September 22, 2010
Met with City of La Pine staff	Review transportation issues on 97	September 22, 2010
BOCC work session	Deschutes Junction policies	September 29, 2010
COIC meeting	Develop plan for alternative modes	October 7, 2010
ODOT TAC	Tumalo, Prineville Junction	October 25, 2010
ODOT access meeting on 97/20	Again discuss County roads	November 19, 2010
Board work session	Deschutes Junction	December 1, 2010
ODOT Project Team	US 20 in Tumalo	December 7, 2010
COACT meeting	ODOT projects and local plans	December 9, 2010
Meeting with DLCD director, staff	Discuss TPR and rural projects	January 18, 2011
PC work session	Proposed TSP projects	February 24, 2011
Deschutes National Forest	TAC meeting on transit in the woods	March 1, 2011
Board work session	TSP projects to address 2030 failures and Deschutes Junction policies	March 16, 2011
Board public hearing on TA-10-6	Deschutes Junction policies	March 28, 2011
Board public hearing on TA-10-6	Deschutes Junction policies	April 18, 2010
Board work session on 97/20	Effect on County roads	May 4, 2011
Citizens, Road Dept. meeting	Discuss Tumalo	May 5, 2011
Board hearing on TA-10-6	Board approved Des Jct policies	May 23, 2011
PC work session on TSP	General overview	May 26, 2011
TSP Open House #3, Sisters	Present 2030 projects, get input	June 6, 2011

Event (con't)	Activity (con't)	Date (con't)
TSP Open House #3, La Pine	Present 2030 projects, get input	June 8, 2011
TSP Open House #3, Bend	Present 2030 projects, get input	June 13, 2011
TSP Open House #3, Terrebonne	Present 2030 projects, get input	June 15, 2011
Board work session	Funding County roads	June 22, 2011
Sisters Open House	Discuss US 20 lanes	August 29, 2011
Sisters Open House	Continued discussion of US 20 lanes	October 4, 2011
Planning Commission meeting	Work session on TSP Update	October 13, 2011
Des River Woods Neighborhood Assoc.	Present draft TSP, get DRW input	October 20, 2011
Planning Commission public hearing	Present draft TSP Update	October 27, 2011
Board work session	Review selected TSP issues	November 7, 2011
Planning Commission public hearing	Continued hearing on TSP Update	November 10, 2011
PC public hearing in Sisters	Continued hearing on TSP Update	December 15, 2011
Meet w/CO Landwatch, 1000 Friends	Discuss TSP on bikes, US 20	December 20, 2011
PC work session	Discuss major TSP topics	January 12, 2012
Planning Commission public hearing	Continued hearing on TSP Update	January 26, 2012
Planning Commission public hearing	Begin deliberations on TSP Update	February 3, 2012
Planning Commission public hearing	Recommend TSP Update to Board	February 23, 2012
Board work session	Recap major topics in TSP Update	March 26, 2011
Board public hearing	Public hearing on TSP Update	April 16, 2012
Board public hearing	Public hearing on TSP Update	April 23, 2012

4.3 Transportation Issues Identified in TSP Update Process

Transportation issues raised during the nearly three-year TSP Update process ranged from broad overarching themes to items as specific as a tree blocking the sightline on a curve. Issues such as the latter were forwarded to the Road Department to be addressed during routine maintenance operations; they were not cataloged in the TSP Update. Transportation topics are organized geographically with Countywide aspects presented first. Specific locations are discussed in the following manner: north to south along the US 97 corridor; west to east along the US 20 corridor; and west to east along the OR 126 corridor. While the text is organized by State highways, County arterials and collectors are also discussed as are off-highway topics.

Issues that Pertain to all of Deschutes County

Topic: Ability to Fund Future Road and Highway Improvements

Response: This was a major component of the public's comments. Deschutes County initiated a Countywide transportation system development charge (SDC) in 2008 with Board Resolution 2008-059. The County updates the amount annually based on a price index for construction materials published in *Engineering News of Record* for Seattle, WA. However, declining revenues from state and federal sources mean it will be difficult to finance future transportation projects.

In 2011 the Board directed the Road Department to convene a committee to examine other funding opportunities for road maintenance. That committee's work will likely be completed in early 2012. The funding committee will include many of the same members who helped develop the Countywide transportation SDCs and thus are familiar with the issues. New funding sources for road maintenance could result in more County funds being available for modernization projects.

A deeper discussion of transportation funding is found in Chapter 6.

Topic: High Accident Locations

Response: These are tracked by both Deschutes County and ODOT via a crash data base. A list of the County intersections is found at Table 2.2.T6. No County intersection in 2005-2009 had a crash rate that exceeded 1.0 crashes per million entering vehicles (MEV), which is considered the threshold amount that would require countermeasures.

There were four County segments that exceeded the statewide average for similar roads. While improvements to shoulders and clear zone improvements would have provided some benefit, driver error was predominantly the causal factor.

For State Highway intersections on rural lands, four locations made the Top 10% of the Statewide Priority Index System (SPIS); ODOT and the County have already addressed three:

1. ODOT and the County closed one leg of the US 97/Gift-Deschutes Pleasant Ridge;
2. The County, ODOT, and City of La Pine are working to identify and schedule remedies for US 97 in La Pine; and
3. ODOT and Deschutes County are nearing the end of a project development to arrive at a long-term solution for US 20 in Tumalo.

Topic: "Four-Phase Approach" to Improve Two-Lane State Highways

ODOT has a "four-phase" approach to incrementally improve rural two-lane highways to divided highways with frontage roads and grade-separated interchanges, removing all direct at-grade access. This approach includes:

- Addition of passing or climbing lanes every three to five miles
- Widening to a four-lane section by connecting passing lanes or adding lanes
- Adding grade-separations and raised medians
- Adding full grade-separated interchanges and frontage roads

County and ODOT staff through a coordinated process identified the general location of future passing lanes as well as overpasses and interchanges. Specific locations and footprints will be done during ODOT's project development. As intersections begin to experience operational and/or safety problems, they will be either grade-separated, restricted, or closed provided there is reasonable alternate access. Per state statute, the Board of County Commissioners must approve any disconnection of a County road from a State highway.

Topic: County Roadways Lack Adequate Capacity

Response: The 2030 traffic model and Technical Memo #3 identified a few sections and/or intersections of County arterials and/or collectors that did not have enough capacity. Technical Memo #4 identified either additional travel lanes (western Redmond) or center turn lanes (La Pine, western Redmond) or roundabouts (eastern Bend) as solutions. A more specific discussion of County projects is found in Chapter Five.

Topic: State Highways Lack Adequate Capacity

Response: The 2030 traffic model and *Technical Memo #3* identified sections and/or intersections of State highways that did not have enough capacity. *Technical Memo #4 Mitigations Alternative Analysis* identified either additional travel lanes (west of Sisters; Bend-La Pine; Tumalo-Bend) or potential interchanges (Lower Bridge Way/US 97; Quarry Road/US 97; Burgess Road/US 97; Old Bend-Redmond/US 20) or overpasses with jug-handles (Cook-O.B. Riley/US 20 in Tumalo) or roundabouts (Hamby-Ward/US 20 and Powell Butte Highway/US 20). *Technical Memo #4 is in Appendix B.* A more specific discussion of State projects is found in Chapter Five.

Roundabouts are an internationally, nationally, regionally and locally recognized traffic control device. However, the use of roundabouts has become a sensitive topic with the Oregon trucking industry, which has concerns about the ability of roundabouts to adequately accommodate oversized-loads. Any roundabouts on State highways will be designed by ODOT to ensure consistency with ORS 366.215, the ODOT Highway Division's Mobility Operations Manual, and with input from ODOT's Motor Carrier Division and other stakeholders identified by the agency.

Deschutes County will base any financial contributions to intersection improvements beyond providing/extending turn on the County's percentage of the cost of a rural roundabout. If the State chooses to pursue a higher-level solution such as a grade-separated interchange, the County will still base its financial contribution on the County's percentage share on the costs of a rural roundabout.

Topic: Desire for a Regional or County-Wide System of Non-Highway Bicycling Routes

Response: While ODOT's highways have the widest shoulders of any facility in the region and link all of the County's and region's cities, those same highways have the highest speeds, traffic volumes, and amount of heavy trucks. Additionally, to prevent sleepy motorists from running off of the pavement, many highways have "rumble strips" on the shoulders which can play havoc with a bicycle wheel and can collect debris.

By contrast County roads have much lower volumes, but those same two-lane roads can have shoulders that range from ample to adequate to marginal to non-existent. During pavement preservation or modernization projects the County will widen shoulders out to the standards set in the County code at DCC 17.48, Table A, provided no right-of-way purchases or extensive cut and fill operations are required. The County considered wider right-of-way widths for arterials and collectors within three miles of a UGB, which in turn would then have wider shoulders to accommodate cycling commuters and students riding to/from school. The County decided against such a policy due to the cost to acquire additional rights-of-way versus the small number of potential users and the relatively short cycling season.

The County will designate a bikeway system based on the routes identified for the Three Sisters Scenic Bikeway and the recommendations of BPAC. Designation will include wider striping on the fog lines and improved signage in the rural area, but will not include bike stencils on the shoulder as are found on urban bike lanes. In unincorporated communities, the County will consider bike stencils.

Topic: Desire for a Regional or County-Wide System of Pedestrian Trails

Response: The County recognizes the importance of trails from an amenity and public health perspective and would be supportive of grant applications to create a trail system on County rural and unincorporated lands that would tie into an urban trail system as well as trails systems on federal lands and resorts.

Yet, the majority of land within Deschutes County is in federal ownership. The USFS and BLM provide the bulk of the region's pedestrian recreation. Additionally, the County does not have a Parks District, instead deferring to the Parks and Recreation districts of the four cities and other private or non profit organizations such as the Central Oregon Trail Alliance. The Road Department does not currently have the staffing or equipment to build or maintain trails.

Nevertheless, the County will map a series of proposed pedestrian trails (see Chapter 5 for specifics) in coordination with Bend, La Pine, Redmond, and Sisters. Many of these rural trails would utilize the ditch rider roads of area irrigation districts.

The intent is for third parties to cite the trails mapped on the TSP to then seek and obtain grant funding to build and maintain those trails.

Topic: Expanded Transit Service

Response: CET provides a tri-county transit service and staff is working with Central Oregon Intergovernmental Council (COIC) and CET on a planning project to develop a long-range transit master plan that will identify potential service expansion in terms of location or hours. Staff is also working with the Bend MPO on a long-range transit plan. Both projects are due to conclude after the TSP Update but their recommendations could be incorporated into the TSP through a subsequent amendment.

Topic: Establish Passenger Rail Service, Either Inter-County or Intra-County

Response: Currently, with the exception of a few private excursion trains, there is no passenger rail service. Burlington Northern Santa Fe Railway has said it was reluctant to cede rail capacity to passenger rail at the expense of more profitable freight operations. The Central Oregon Area Commission on Transportation (COACT) Rail study and the on-going COIC long-range plan regarding Central Oregon transportation options will revisit the issue. Given the low-population densities in Madras, Redmond, Bend, and La Pine as well as the lack of fixed-route transit service in any city except Bend, the abundance of free parking in the four cities, and low travel times along the US 97 corridor, it is doubtful passenger rail is feasible even in the next 20 years.

A more likely outcome would be establishing bus rapid transit (BRT) as an alternate mode and precursor to passenger rail.

Topic: Accommodate Rail Freight Movements

Response: The COACT Rail Study identified a list of prioritized existing at-grade railroad crossings within the tri-county region that would be either closed or improved to grade-separated railroad crossings. The bulk of the crossings are in the cities; the only high-priority County crossing is at Baker Road just beyond the southwest edge of the Bend UGB.

The COACT Rail report found it was not cost-effective to relocate the railroads out of Bend and Redmond. The preliminary cost estimate was $617 million to relocate the railroad around Bend and Redmond whereas improving existing at-grade crossing south of Bend to the north of Redmond had a preliminary cost estimate of $386 million.

A relocation would simply replace urban at-grade crossings with rural at-grade crossings or require the building of grade-separated crossings for low-volume rural roads. The rail relocation would require a literal act of Congress to provide the railroads with the same property rights on a new alignment that they now possess on the current alignment. There were also major environmental and socio-economic challenges to establish new right-of-way for the railroad. Finally, relocating the railroad would be an all or nothing approach with huge upfront costs whereas improving existing at-grade crossings can be done in a phased approach.

The County supports the efforts by ODOT and the City of Prineville Railway (CoPR) to realign the O'Neil Highway and grade-separate the US 97/O'Neil Highway intersection to not only improve safety and eliminate truck-length restrictions, but also to help the CoPR enhance its capabilities to serve local freight shippers.

US 97 Corridor

Terrebonne Area

Topic: US 97 Acts as a Barrier Due to Traffic Volumes, Speeds, and Vehicle Mix

Response: At several open houses for both the Terrebonne Community Plan and the TSP Update, residents aired these concerns. The main areas of discussion were the Lower Bridge Way/US 97 intersection and the segment of US 97 between C Avenue and South 11th Avenue.

ODOT has done channelization improvements at Lower Bridge Way/US 97, but will look at a long-term solution of either a simple overpass (meaning no direct connection to the highway) or an interchange. Any planned solution at Lower Bridge Way will have to look at the highway through the rest of the community.

At the open houses there was no strong preference among the options of a bypass, a couplet (11th Street would be northbound, current US 97 would be southbound), an interchange or overpass, or a traffic signal. Residents generally preferred no change. Residents, ODOT, and the County all agreed that the highway would not be widened beyond its current three-lane configuration.

ODOT will continue to monitor the performance of US 97 in Terrebonne to determine when a refinement plan should be initiated. Potential triggers could be the majority of intersections in Terrebonne either not meeting ODOT's V/C ratio, excessive queuing on County roads due to lack of gaps in traffic, a higher than above average crash rate than the statewide average for similar facilities, or the emergence of a Safety Priority Index System (SPIS) site.

Topic: Secondary Access to Crooked River Ranch

Response: Planning and Road Department staff have worked with Crooked River Ranch (CRR) and Bureau of Land Management (BLM) to identify an emergency secondary access from CRR to NW Quail Road south to Lower Bridge Way. The emergency access reaches Lower Bridge Way to the east of Steamboat Rock. A right-of-way agreement with BLM is pending.

Redmond Area

Topic: Replace the At-Grade Crossings of the BNSF and CoPR at O'Neil Junction

Response: The COACT Rail Plan identified high-priority crossings within the tri-county area that would be grade separated. Of those, two are in Deschutes County with the northernmost being one at O'Neil Junction or as it's known for railroad purposes, Prineville Junction. This project is estimated to cost $18 million.

Topic: Need for a "Ring Road" on the West Side

Response: The 2030 model and the Redmond TSP indicate existing roads need to be improved to add capacity as US 97 begins to become more congested and as the City's lands west of US 97 begin to develop. Helmholtz will be widened and turn lanes added from north to south. Eventually, Helmholtz will be extended southeastward to connect to a future interchange at Quarry/US 97. The lands between US 97 and Helmholtz are Multiple Use Agriculture, 10-acre minimum (MUA-10) so no exception is required for Statewide Planning Goal 3.

County staff anticipates once a precise alignment to extend Helmholtz to US 97 has been identified, the City of Redmond will be the land use applicant.

Topic: Redmond Re-Route, Phase II to Extend from OR 126 Southward

Response: ODOT modeling has indicated a deficiency on the current five-lane section of US 97 south of OR 126 all the way down to the Redmond UGB. The 1998 TSP and the TSP Update both include a Quarry Road interchange. ODOT and the City of Redmond are in the midst of a long-range plan to identify whether the Re-Route's southern terminus is an upgraded Yew Avenue interchange or a new

interchange at Quarry Road/US 97. To date County has been a minor participant as the plan has focused on the north end of Phase II and access to downtown Redmond plus highway connectivity. Once the planning efforts return to the issue of Yew vs. Quarry, the County will again become a more active participant. If the preferred alternative extends to Quarry an exception to Statewide Planning Goal 3 would be required as the lands on the east side of US 97 are zoned EFU.

County staff anticipates either the City of Redmond or ODOT will be the applicant for any land use approvals or goal exceptions for an extension of US 97 or a City arterial to Quarry Road.

Topic: Bypass of Redmond

Response: The public has often asked about the possibility of bypassing Redmond to the east. The Redmond TSP has looked at this issue and essentially, the requirement of the bypass to swing eastward enough to clear the runway protection zones means a bypass would not be that effective from a time standpoint. The lower cost of BLM lands would be offset by higher construction costs of a longer bypass.

Additionally, the combination of the Redmond Re-Route Phase II and the existing Redmond Re-Route will provide a faster route through Redmond, essentially providing an operational bypass of Redmond, alleviating the immediate need for a geographic bypass.

Topic: Relocate Railroad to East of Redmond

Response: The cost of relocating the BNSF only through the Redmond area was $176 million versus $182 million to grade-separate the existing crossings. While the costs are nearly the same, the previously discussed challenges (upfront costs for relocation and its all or nothing nature as compared to phasing capability of improving at-grade crossings; socio-economic aspects of a new alignment; need for literal act of Congress to provide same property rights on new alignment as found on old) resulted in the COACT Rail Study recommending this option be dismissed.

Topic: Future Extension of NW Walnut West to Helmholtz

Response: Affected property owners have requested a sense of the timing of extending a future collector in the vicinity of NW Walnut Avenue west to Helmholtz. The County has no plans to construct this extension; instead construction would be done as part of a development proposal. Citizens were also concerned about the location of the intersection of this future collector and Helmholtz being on a curve. The line on the City's and the County's respective TSPs just provides the approximate alignment. As development occurs and right-of-way is actually dedicated is when a more precise alignment would be determined. The alignment could be shifted southward to avoid existing homes and/or structures or those may have to be purchased. During the development process is when the future intersection on Helmholtz would be analyzed for sight distance and NW Walnut/Helmholtz would be examined for crash history and sight distance.

Topic: Bicycle and Pedestrian Access to Smith Rock State Park

Response: Staff coordinated with the BPAC to identify which County roads and canal ditch rider roads that could be utilized to access Smith Rock State Park.

Bend Area

Topic: Deschutes Junction Frontage Road and/or Interchange Upgrade

Response: This interchange lies approximately five miles north of Bend on US 97. Several nearby rural subdivisions (Boones Borough, Starwood, Vale View, etc.) use the interchange to reach Bend and Redmond. The crossroads also supports some small-scale commercial and industrial property. Residences and business and property owners are interested in ODOT's long-term plan for the current interchange.

The agency has no plans to upgrade the facility at this time as the interchange is sufficient for the rural uses allowed under the zoning. ODOT has emphasized its desire to extend a raised median from the current one. The initial extension of the raised median would be north to Gift Road as well as south for an undetermined distance. The agency recognizes the out of direction travel that would result and thus has stated the current raised median would not be extended until a frontage road was in place on the west side of US 97. (The east side has little residential development to the north and Deschutes Market Road provides an alternate route.) The raised median is needed to address safety issues of crossover crashes as traffic volumes increase and to provide a countermeasure for icy winter driving conditions.

The County at TA-10-6 (implementing Ordinance 2011-005) has agreed to conduct a Deschutes Junction Master Plan once the Board directs staff to begin.

Topic: Future Interchange on US 97 at North End of Bend

Response: ODOT has worked with the City of Bend and Deschutes County to identify a long-term solution for US 97 between Deschutes Market Road and Empire Avenue. The agency's draft Environmental Impact State (DEIS) was issued in summer 2011 for a 45-day public comment period. Once the comments are received, ODOT will select a preferred alternative in the EIS and issue a Record of Decision (ROD). The County has commented on the various alternatives and reviewed the potential traffic circulation effects on County roads in the area west of US 97, east of Hunnell Road, south of Fort Thompson, and north of Cooley roads.

The preferred alternative will decide the interchange's location and whether it will accommodate all moves or just southbound off, northbound on. ODOT and the County will also identify effects on County roads and which might need to be improved. The County's main concern is Hunnell Road and its role as a future north-south connector between Tumalo Road and the triangle formed by US 20, US 97 and Cooley Road. As ODOT proposes to close driveways onto US 97 the need for a parallel local route will intensify.

Topic: Improved Local Circulation in the US 20/US 97/Cooley Road Triangle at North End of Bend

Response: This topic is intertwined with the ODOT US 97 project described earlier. The area bounded by US 97, US 20, and Rogers Road has few north-south or east-west routes. As either the ODOT project is implemented or development occurs, Hunnell Road will be improved between Cooley to at least Rogers Road. Ultimately, Hunnell will be paved to Tumalo Road as either development occurs or funding becomes available. The County will also work with ODOT to improve east-west circulation between Hunnell Road and Old Bend-Redmond Highway.

Topic: Eastside Bypass of Bend

Response: The concept of an eastside bypass has been around for almost six decades. Earlier versions suggested 27th Street, then a County road, as the bypass. As the City has developed, the list of potential County donor roads has shifted ever eastward. The route most often mentioned now is a combination of Rickard, Hamby/Ward, and Deschutes Market roads. A variation at the north end uses Empire.

When ODOT in the early 1990s began planning what would become the Bend Parkway, the agency stopped motorists to conduct origin and destination surveys to again revisit the issue of an eastside bypass. These surveys revealed drivers had Bend as a destination and would not use an eastside bypass. The surveys coupled with traffic modeling showed only 10,000 of the 75,000 vehicles then forecast to travel daily through the Bend central corridor in 2015 would use the eastside bypass. Also rural land owners have objected to the intrusion of an urban-scale facility into the countryside.

While people often state an eastside bypass would ease truck traffic volumes on the Parkway and Third Street, much of the truck traffic has an east Bend destination such as The Forum shopping center at 27th/US 20 for example.

There is remnant public sentiment for an eastside bypass even post-Parkway. The lack of right-of-way protection or acquisition has meant lost opportunities for a future bypass. Instead of a single high-cost, high-speed roadway, the north-south travel demands can be met via current arterials and collectors along with a future extension of the grid system to east of Bend.

With the addition of possible lower cost road links and some roadway upgrades, the distribution of future north-south traffic throughout a grid system of existing arterials and collectors could have the following benefits:

- Less capital and ongoing maintenance costs
- Less disruption to existing residents
- Opportunity to retain the rural character of the area
- Less pressure to create and develop commercial areas east of 27th Street
- Maximization of access to individual properties
- Maintain lower overall speeds
- Maintain emphasis on use of the Parkway by autos and through trucks

Topic: Expansion of Bend Airport

Response: The City update of the Bend Airport Master Plan is due to be completed by winter 2012. The potential runway expansion to the north and any necessary road relocations such as Powell Butte Highway or McGrath Road will be identified in the plan update. An exception to Statewide Planning Goal 3 could be required. Any intensification of land uses at the airport would require traffic analysis to show consistency with the TPR.

County staff expects either City of Bend staff or Bend Airport staff to apply for the appropriate land uses applications and provide TPR findings.

Topic: Pave Sisemore Road between Plainview and Tumalo Reservoir Road

Topic: Staff looked at this and in 2008 arrived at a preliminary cost estimate of $5 million. The main constraint is widening the road where it crosses an old earthen dam and widening the road cuts on

either side of the dam. As the road is currently passable for motor vehicles, mountain bikes, and cross bikes, the only group not served would be those on road bicycles. Staff therefore found this request does not have a favorable cost-benefit ratio.

Topic: Trails in the Rural Areas Adjoining Bend

Response: Staff worked with City of Bend and Bend Metro Parks and Recreation Department and BPAC to identify potential trail routes for off-road bikes and pedestrians. These would provide links to adjacent federal lands as well as Smith Rock State Park. The latter would use the Trans-Canada pipeline ditch rider road.

While Deschutes County will map these trails, they will be constructed either as development occurs or as third parties win grants. The proposed trails are mapped and discussed in Chapter Five.

Topic: Frontage Road from the Ponderosa Neighborhood to Baker Road

Response: The South Parkway Refinement Plan was discussed and the Southwest Neighborhood Association has requested a frontage road going south from the Ponderosa neighborhood south to Baker Road. The frontage road will be added to the TSP map.

Topic: Replace the at-grade crossings of the BNSF at Baker Road

Response: The COACT Rail Plan identified high-priority crossings within the tri-county area that would be grade separated. The Baker Road at-grade crossing is listed as a high priority with a cost estimate of $36 million. Complicating factors that will also need to be addressed are the effects on ramps of the US 97/Baker-Knott road interchange plus circulation and access to the Deschutes River Woods store and the Deschutes River Woods neighborhood.

Topic: Alternate Access to the High Desert Museum

Response: As traffic volume rise on US 97, the current access to the High Desert Museum will likely prove to be problematic. ODOT, the County, and the museum will work to identify either phased improvements to the existing access, including possible turn restrictions, to ultimately an alternate access via either a frontage road or other alternate route.

Topic: Improve Non-Highway Access Between Bend and Sunriver

Response: The County supports the paving of USFS #41 between Sunriver and Cascade Lakes Highway to provide an alternative to US 97. Additionally, the County will continue to work with ODOT and the USFS to identify and develop a non-highway paved route between Bend and Lava Butte and then Lava Butte to the north edge of Sunriver.

Topic: Reclassify South Shawnee Circle from Collector to Local Road

Response: Residents of Pinewood Country Estates feel the amount and speed of cut-through traffic is damaging South Shawnee Circle, which is maintained by a special road district. Between South Century Drive and La Pine State Rec Road, the following routes are designated as collectors for future collectors: Lazy River Drive to South Shawnee Circle to Wolf Street to Whittier Drive to La Pine State Rec Road. Residents think a more logical route would be to replace South Shawnee Circle with Tamarack Road to White Oak to Powell to Wolf, making those streets the collectors.

Planning and Road Department staff drove both routes and feel South Shawnee Circle still offers more advantages as there are fewer 90-degree turns.

Topic: Disconnect Vandevert Road

Response: ODOT as part of its four-phased approach has identified intersections where mainline volumes are high enough that a substantial number of drivers on the side street will not have adequate gaps to turn onto or cross the highway. In the case of Vandevert, drivers wishing to go north on US 97 have an alternate route of Huntington Road to South Century. The latter accesses the highway through a grade-separated interchange.

Disconnecting Vandevert Road from US 97 will require a formal request from ODOT and a public hearing before the Board of County Commissioners.

Topic: Future US 97 Bypass of La Pine/Wickiup Junction

Response: Several members of the public have mentioned their desire for a US 97 bypass from Wickiup Junction beginning about Drafter Road and extending south through La Pine. Their concept had the bypass along the west edge of the BNSF. ODOT also has a long-term plan to improve the Burgess Road/US 97 intersection to remove US 97's at-grade crossing of the BNSF. Given both the interchange and a bypass would be within the City of La Pine, the topic is better addressed through the City's forthcoming TSP. The southern terminus, if it extends to OR 31, would have a small amount on County land.

Topic: Access to Isolated Subdivisions in La Pine Area

Response: There are numerous subdivisions in South County that only have one road, sometimes not even paved, leading into and out of area. In the case of the need to evacuate from either flames or floods, this is a less than ideal situation. Staff worked with the La Pine TAG and La Pine Fire Department to identify such subdivisions and to seek grant funding to improve the access to and from these areas.

Topic: Congestion at OR 31

Response: The traffic model indicates the US 97/OR 31 intersection does not meet the State's V/C ratio by 2030. A phased series of improvements of adding separate left and right turn lanes on OR 31 should be done prior to a directional grade-separated interchange. The main issue is there are not sufficient gaps for westbound drivers to turn left from OR 31 to go south on US 97. Separating the turn lanes will minimize the delay for those wanting to turn right from OR 31 to go north on US 97 who otherwise could begin to queue up behind the motorists waiting to turn left.

US 20 Corridor

Sisters Area

Topic: Four Lanes on US 20 Between Black Butte Ranch and the West Edge of Sisters

Response: The 1998 TSP showed passing lanes on US 20; the 2030 transportation-land use model indicates there is still a need for US 20 to become four lanes for capacity and safety reasons. There

have been comments from the public and the City of Sisters against the additional lanes due to fears of increased volumes arriving in Sisters at a high speed.

This segment of US 20 is a Statewide Highway as well as being an Expressway and a Freight Route. The intent is for such facilities to carry high volumes of traffic at high speeds. US 20 links the Upper and Middle Willamette Valley to Central Oregon, carrying a large amount of recreational traffic in both winter and summer. The combination of traffic volumes, slower semi-trucks, and slower RV's or pick-ups pulling trailers creates long queues. A lack of passing lanes, especially for eastbound traffic where there are fewer passing opportunities, means even more frustrated motorists will continue to make either unsafe passes or illegal passes.

Providing passing lanes in both directions every three to five miles with the ultimate goal of knitting them together for a four-lane highway is an appropriate response. When an urban street begins to fail there are a number of countermeasures available. Parallel, local routes can be improved; traffic signals can be added to a street or existing signals can have their timing modified; driveways can be closed or interparcel circulation can be improved; modals shifts to transit or biking and walking can be encouraged, etc. When a rural, two-lane highway begins to fail, those measures are not available, leaving adding lanes as about the only recourse.

Finally, a four-lane US 20 entering the west edge of Sisters is consistent with the four-lane section assumed by the City of Sisters TSP for the urban portion of US 20 at the west edge of town.

Recognizing the concerns of rural residents and the City of Sisters, ODOT and County staff identified the following "triggers" that would indicate the potential need for a passing lane and the requirement that ODOT have an active dialogue in Sisters after funding is programmed for these improvements but well before they are designed or constructed:

On the US 20 segments of 1) Hawks Beard (Black Butte Ranch) to Tollgate and 2) Tollgate to Rail Way (west edge of City of Sisters) ODOT will consider adding travel lanes when congestion, operation or safety concerns indicate additional lanes would be an effective countermeasure for the identified deficiency. Indicators that an improvement may be needed include, but are not limited to:

- The traffic volumes exceed ODOT's volume/capacity ratio targets
- The crash rate exceeds the Statewide average for similar rural highways
- The crash types are related to passing maneuvers (head-on, sideswipe oncoming, sideswipe overtaking)
- The segment includes one or more top 10% Safety Priority Index System (SPIS) sites
- An increase in Percent Time Spent Following or a decrease in Travel Time Reliability
- Prior to design, ODOT will hold a public meeting in Sisters to explain the purpose, need, and timing of the project and to receive and consider the viewpoints of Sisters area residents and how they might be best addressed in terms of project design and construction.

Topic: Off-Highway Route from Tollgate to Sisters

Response: Local motorists, cyclists, and equestrians have sought a parallel route from the Tollgate area to Sisters, especially to the high school and middle school. However, there has not been consensus as other residents of Tollgate and other subdivisions have voiced opposition to such a paved route. Lacking an agreed common vision, the TSP is currently mute on the topic.

Topic: Bypass of Sisters

Response: The topic of a highway bypass around Sisters has waxed and waned. Potential routes have looked at going to the north or south of Sisters with the southern route having slightly fewer challenges. In the City's TSP Update, there was no support expressed for a bypass by either the public or ODOT. The City of Sisters TSP has shown with planned improvements the current State highways and City streets can accommodate the forecast levels of 2030 traffic. Therefore, the County TSP will not identify any potential bypass routes.

Topic: Provide Non-Highway Access Between Sisters and Bend

Response: Area road cyclists currently have no direct way to travel between Sisters and Bend other than US 20. BPAC, ODOT, and the County have discussed three options: pave the Brooks-Scanlon logging railroad; pave Sisemore Road; add a paved separated path within the US 20 right-of-way.

Brooks-Scanlon

Staff has looked at the route, which follows the bed of an old logging railroad, from Three Creeks Road to Johnson Road near Shevlin Park. This mostly level route traverses through the forest and offers outstanding views. However, much as was the case with Sisemore Road, Brooks-Scanlon is currently passable for motor vehicles, mountain bikes, and cross bikes; the only group not served would be those on road bicycles. Additionally, Brooks-Scanlon has a seasonal closure to protect a deer wintering range.

The Brooks-Scanlon is under the jurisdiction of the Deschutes National Forest (DNF) where it is called Road #4606. The County under Resolution 2009-018 is not accepting any new roads into the County-maintained system, although the Board may make an exception for arterials and collectors. However, the current Brooks-Scanlon is not built to County standards for those designations.

Based on the above, (few users, seasonal closures, not part of County-maintained system, costs to upgrade and maintain) staff therefore found this request does not have a favorable cost-benefit ratio. The County would support any grant applications by third parties to pave and maintain Brooks-Scanlon.

Sisemore Road

See the Bend section above on paving Sisemore.

Separated Paved Path within US 20 Right-of-Way

There are a few challenges to this alternative, which is the best of the three. The issues/questions include but are not limited to; is there sufficient right-of-way to separate users from highway traffic; how to meet driver expectations when the path crosses private driveways or public streets, and how the path would be maintained?

Additionally, improvements to Tweed Road would offer cyclists a paved, albeit zigzag route, to enter Bend via Tweed, Couch Market, Tumalo Reservoir, and Tyler roads once they reach Tweed via a separated path within the US 20 right-of-way.

Topic: US 20 as a Barrier in Tumalo

Response: Residents of Tumalo, cyclists, pedestrians, and equestrians, as well as motorists have found the US 20/Cook-OB Riley intersection to be problematic. ODOT in summer 2010 installed a raised median at US 20/7th-Bailey as a short-term improvement. The agency and County are in the late stages of selecting a long-term improvement to have a grade-separated crossing of US 20 at either OB Riley-Cook or 7th-Bailey. The County prefers OB Riley-Cook to preserve route integrity and minimize the turning movements at Fifth/Cook. Not all members of the community are accepting of the ODOT concept and would prefer a traffic signal or roundabout.

Due to lack of potential near, mid, and long-term funding that may be available to construct either the C-4 or I-3 improvement projects, it is suggested that ODOT, Deschutes County, and Tumalo area stakeholders develop an interim solution which provides the necessary incremental system capacity designed in a safe and practical manner. Suggested improvements could include signalization, speed reduction, bicycle and pedestrian crossing improvements, and other similar treatments designed with consideration to the long term vision for the highway through Tumalo. All interim improvement concepts should consider both the needs of the highway user and the Tumalo community.

Once a long-term preferred alternative is reached, ODOT and the County will pursue funding to construct the improvement. Of the two ODOT final long-term concepts, C-4 takes the County road over US 20 while I-3 takes the County road under US 20. The County through the TSP public hearing process expressed a preference for I-3. Additionally, the County recognizes the concerns of Tumalo residents regarding the way the long-term project could affect their community and requires that ODOT have an active dialogue in Tumalo after funding is programmed for this long-term project but well before they are designed or constructed:

- Prior to design, ODOT will hold a public meeting in Tumalo to explain the purpose, need, and timing of the project and to receive and consider the viewpoints of Tumalo area residents and how they might be best addressed in terms of project design and construction.

Topic: Tumalo Trail

Response: Complementing efforts to provide a conflict-free crossing of US 20, Tumalo residents have desired a path linking the community to Tumalo State Park. Staff from Planning Division, the Road Department, Bend Parks and Rec, and Oregon State Parks have all agreed to the concept of having a trail on the west bank of the Deschutes River that would cross underneath US 20, linking the town and park.

Staff has not been successful in several previous grant applications, but will continue to pursue funding for this project.

Topic: Relocate US 20 to Connect to Northeast Bend and Points East

Response: Travelers on US 20 who want to continue south on US 97 now enter Bend, proceed south on Third Street for a block, turn left at Empire, then a right turn to access US 97. Another option is to continue south on Third Street through multiple lights, then access US 97 just south of Butler Market/Mount Washington. Travelers wishing to continue east on US 20 go south on Third Street to Greenwood and turn left. Several members of the public have proposed easing congestion on Third Street and Greenwood by relocating US 20.

The two relocations most often mentioned are a new east-west road at the north end of the UGB that would go directly east to Deschutes Market Road and then send US 20 down either 27th Street or Hamby Road to the current alignment of US 20. A second concept is to reroute US 20 just past Gerking Market Road to angle northeast to connect to Tumalo Road, then making Tumalo Road the state highway all the way east to Deschutes Market Road and then follow the first alignment mentioned above. A third alternative is to use the Tumalo Road concept, but continue east on Morrill Road to Powell Butte Highway, then south on Powell Butte Highway to the current alignment of US 20. A fourth approach is to again use Tumalo Road as US 20, but then turn McGrath Road into US 20 and connect to Powell Butte Highway near the Bend Airport and again following Powell Butte Highway to the current alignment of US 20.

A common misconception is US 20 traffic is predominantly through traffic bound for Burns and beyond. Yet, much of the traffic on US 20 (85% according to ODOT) has destinations in Bend and thus would likely continue to use Third Street regardless of whether US 20 was rerouted. The Oregon planning system stresses first attempting to solve urban traffic problems with UGB's instead of building new roads on rural lands. ODOT's Policy 1G, Major Improvements, emphasizes maximizing system efficiency and management prior to new construction. ODOT's Policy 1H, Bypasses, echoes that language to demonstrate need and requires several restrictive aspects of access and land uses to ensure the long-term operation of new bypasses.

The current modeling does not show widespread deficiencies on US 20 and thus does not support the need for relocating US 20 at this time.

Topic: Pave Frederick Butte Road

Response: Agricultural shippers with origins and/or destinations in Christmas Valley or portions of northern Lake County use OR 31 then US 97 to reach Bend. Paving Frederick Butte Road would reduce the length of their trip and send them on a State highway with much more capacity.

Staff has driven the route and looked at the freight volumes, but does not feel there is enough traffic to warrant pursuing the concept at this time.

OR 126 Corridor

Sisters Area

Topic: Extend Barclay East of Town, then South to OR 126

Response: The City of Sisters TSP indicates with planned improvements there is adequate capacity on OR 126. Given that fact, the existence of floodplains, and the pattern of existing rural residential development, there is not an identified need to add a Barclay Extension to the County TSP at this time.

Redmond Area

Topic: Needed Capacity on West Side of Redmond

Response: The City of Redmond TSP and the County's 2030 traffic model all indicate the need to develop a north-south "ring road" on the west side of Redmond. As congestion increases on OR 126 and US 97, travelers will divert to County roads. Additional travel and turning lanes will be needed on Helmholtz,

South Canal Boulevard, and 61st Avenue. This will include extending Helmholtz to a future interchange at Quarry/US 97. The County TSP identifies and prioritizes these improvements in Chapter Five.

Topic: Needed Capacity on East Side of Redmond

Response: The City of Redmond TSP and the County's 2030 traffic model indicate the need to add capacity to OR 126 at the east edge of town to the Crook County line. As described elsewhere, there are a significant number of commuters from Prineville and Powell Butte to Redmond. The County TSP identifies and prioritizes these improvements in Chapter Five.

Topic: Expansion of Runways at Redmond Airport and OR 126

Response: When Runway 22 is extended to the northeast for 1,500 feet, OR 126 will need to be located to keep the highway out of the runway protection zone (RPZ). The approximately $6-million extension is anticipated to happen between 2015 and 2024. The intent is to shift the highway to the north. The lands around the airport are EFU so an exception to Statewide Planning Goal 3 would be needed. Other potential options are putting the highway underneath the runway or seeking a waiver from the Federal Aviation Administration (FAA).

County staff anticipates either Redmond Airport, City of Redmond, or ODOT would be the applicant for the necessary land use approvals.

CHAPTER FIVE

PLANNED IMPROVEMENTS AND POLICIES

5.1 Purpose of the Transportation System Plan

The purpose of the Transportation System Plan (TSP) is to guide the development of a safe, convenient and efficient transportation system that promotes economic prosperity and livability for all County residents. The TSP process identified current and future deficiencies or gaps, selected solutions, prioritized the projects, and provided a planning-level cost estimates. This was done for all modes. The end result is a transportation system equipped to serve the mobility needs at the state, county, and local scale for the movement of people, goods, and services.

The TSP balances the need to reduce the reliance on single occupant vehicles while recognizing the County's geography, transportation needs, and residents' modal (type of travel) preferences and demography. Additionally, the TSP recognizes the County and State's responsibility to solve safety and operational problems on roads and highways. The TSP encourages ridesharing, telecommuting and transit as potential tools to delay the construction of additional roadway infrastructure.

The TSP contains brief descriptions of the required facilities and issues, followed by a complete listing of goals and policies that cover the following areas:

- Coordination and Implementation of the Transportation System Plan;
- Arterial and Collector Street Plan including road network policies, Access Management, Functional Classifications, Road and Street Standards, Level of Service and Capacity, and Facility/Safety Improvements;
- Public Transportation Plan;
- Bicycle / Pedestrian Plan;
- Air/Rail/Water/Pipeline Plan;
- A Transportation System and Demand Management Plan (TSM & TDM).

The TSP includes goals and policies as well as identified projects for the next twenty (20) years. Projects were prioritized as high (0-5 years); medium (6-10 years); or low (11-20 years). The prioritization was based on the combination of factors listed below:

- Evaluating the capacity of the County road system and the state highway network within Deschutes County
- Functional classification
- Current and future traffic volumes
- Crash history analyses based on the County and State database
- Input from Deschutes County BPAC on bikeways
- Gaps in sidewalk networks and proximity to schools
- Discussions with the County Road Department
- Efforts to enhance alternative modes of transportation through compliance with the TPR.
- Input received from the citizen review committee (Deschutes County Planning Commission) and the public outreach process in general.

5.2 Coordination and Implementation of the Transportation System Plan

Rather than being a final document, Deschutes County intends for the TSP to be a living document with timely updates as circumstances dictate. By continuing to monitor and plan the transportation network for all modes, the County can meet the mobility needs of residents, visitors, and businesses/shippers. The following goals and policies are intended to achieve that aspiration.

COORDINATION AND IMPLEMENTATION GOALS AND POLICIES

Goal 1

1. Achieve an efficient, safe, convenient and economically viable transportation and communication system. This system includes roads, rail lines, public transit, air, pipeline, pedestrian and bicycle facilities. The Deschutes County transportation system shall be designed to serve the existing and projected needs of the unincorporated communities and rural areas within the County. The system shall provide connections between different modes of transportation to reduce reliance on any one mode.

Policies

1.1 Deschutes County shall protect approved or proposed transportation project sites through:

a. Access control measures;

b. Review of future large development and transportation projects that significantly affect the County's transportation system;

c. Requirement of conditions of approval on developments and transportation projects that have a significant effect on the County's transportation system.

d. Collection of transportation System Development Charges (SDCs) for approved land uses as proscribed under BOCC Resolution 2008-059

1.2 The lead agency for review of transportation projects in Deschutes County shall be:

a. Deschutes County for projects completely outside UGBs;

b. The affected city for projects within its UGB; and

c. The State of Oregon, Deschutes County and affected cities on projects involving state-owned facilities that are both inside and outside of a UGB.

Goal 2

2. The Deschutes County TSP shall be continually updated in a timely fashion in order to ensure the transportation system serves the needs of County residents, businesses, and visitors.

Policies

2.1 Deschutes County shall:

a. Identify local, regional and state transportation needs;

b. Develop a transportation plan that shall address those needs;

c. Review and update the plan at least every five years;

d. Continue to coordinate transportation planning with local, regional and state plans by reviewing any changes to Deschutes County local transportation plans, regional transportation plans, the Oregon Transportation Plan and ODOT's State Transportation Improvement Program (STIP); and

e. Continue public and interagency involvement in the transportation planning process.

2.2 Transportation Projects

a. The County shall have a list of transportation projects, adopted by the Board of County Commissioners in accordance with the policies set forth below.

b. The initial Transportation Project List shall be set forth in Table 5.11.T1 of the Transportation System Plan adopted as part of the Resource Element of the Comprehensive Plan. The Board shall update the Transportation Project List periodically by resolution adopted by the Board, without need of a formal amendment to the TSP.

c. New transportation projects shall be included on the County's Transportation Project List. A transportation project proposed for addition to the list shall be subject to an individual land use review only if applicable administrative rules or land use regulations require such review.

d. Transportation or development projects that require a plan text amendment or a conditional use permit may be required to fulfill conditions or implement mitigation measures before approval is granted. Mitigation and conditions may include, but are not limited to:

- Improvement of surrounding roads;
- Limits on level of development;
- Revision of development placement;
- Addition or redesign of access;
- Addition of traffic management devices such as traffic signals, medians, turn lanes or signage; and/or
- Improvements that reduce transportation impacts.

e. Deschutes County acknowledges that land use designations have a significant impact on the overall transportation system and any alterations shall be completed with consideration to traffic impacts on the County road system and consistency with the TPR.

Goal 3

3. The transportation plan and facilities of Deschutes County shall be coordinated with the plans and facilities of incorporated cities within Deschutes County, adjacent counties and the State of Oregon.

Policies

3.1. Deschutes County shall notify ODOT concerning:

a. All land use proposals or actions that would create access onto a state highway or add >100 ADT to any County road intersection with a state highway;

b. Any proposed land use or development within 500 feet of a state highway or public use airport within the County; and

c. Require ODOT road approach permits.

3.2. Deschutes County shall coordinate local plans and land use decisions with state transportation plans, including the Oregon Transportation Plan, the Oregon Highway Plan and other modal plans. These plans provide ODOT policies and performance standards for State Highways within Deschutes County. These ODOT plans also provide the framework for access management on state facilities to protect the capacity and function of the highways.

3.3 The findings of compliance with applicable statewide planning goals, acknowledged comprehensive plan policies and land use regulations, shall be coordinated with the preparation of any Environmental Impact Statement (EIS) required for a proposed transportation facility that is identified on the Deschutes County Transportation System Plan.

5.3 Arterial and Collector Road Plan

Road Network

Whether County roads or State highways, the road network provides the crucial framework for livability, economic development, and the delivery of goods and services. Simply put, whether it's a snowboarder headed to Mount Bachelor, a worker commuting from Prineville, or long-haul trucker making his way to California, a functioning road network is essential. Even a person or a product arriving by air or rail will reach the ultimate Deschutes County destination by the road network via car, bike, or bus. Improvements came from Tech Memo #4, *Mitigation Alternatives* in Appendix B.

The Transportation System Plan (TSP) Project list identifies $306.2 million worth of projects in the next 20 years. Improvements on State Highway segments or intersections total $240.6 million and County road or intersection projects total $61.3 million. County bridge projects are estimated to cost $3.4 million and bicycle and pedestrian improvements total approximately $571,000. See Table 5.3.T1 for complete lists of specific projects. See Figure 5.3.F1 for planned travel and turn lane improvements and Figure 5.3.F2 for planned intersection improvements.

However, the Road Department is facing an austere financial future. The Road Department's challenges are tied to declining revenues from gas taxes, vehicle registration fees, and lower than expected amounts from transportation system development charges (SDCs).

The major historical sources for funding road projects, the federal government and ODOT, are facing their own financial perils. The federal Highway Trust Fund continues to contract and ODOT has projected revenue decreases due to a combination of people driving less, driving more fuel efficient vehicles, a rise of electric vehicles, and inflation. All of these erode the ability of the federal government and ODOT to fund large-scale highway projects for at least the next several years.

Overview of County Roads

The findings in this Plan conclude that the County road network currently in place, except for several specific road segments and intersections, should be adequate to serve the County needs over the next twenty (20) years. The few problematic areas are on western fringe of Redmond, the eastern periphery of Bend, and the west margins of northwest La Pine.

Given the rural zoning of Deschutes County and the fact that the majority of new development will take place on existing lots with existing access, few additional roads are anticipated. New road corridors to isolated subdivisions and new roads linking urban and rural areas are the main exceptions. Any new roads that will be created most likely will be the result of new developments and would therefore be part of land use development review or would be for secondary access or emergency ingress/egress to isolated subdivisions.

In the past destination resorts had an adverse affect upon County roads that then required mitigation at the time of development. The market for destination resorts has ebbed in recent years and many in the industry do not foresee a return to the pace of development from the mid-1990s to 2007. Additionally, Deschutes County has reduced the lands eligible to become a destination resort by approximately 80 percent.

The majority of upcoming road-related projects will consist of safety-related or other upgrades, maintenance and repair. Upgrades, maintenance and repair should be actively pursued to maintain the integrity of the system and not jeopardize the current conditions.

Table 5.3.T1

County Road and Highway Projects

Road Name	Location	Func. Class.	Project	Estimated Cost	Rank
County Intersections					
Powell Butte Hwy	Neff/Alfalfa Market	Arterial	Roundabout	$900,000	High
Powell Butte Hwy	Butler Market	Arterial	Roundabout	$900,000	High
Burgess Road	Day Road	Art/Coll	Turn lanes	$281,250	Med.
Old Bend-Redmond Hwy	Tumalo Road	Art/Coll	Turn lanes	$250,000	Med.
Baker Road	Cinder Butte Rd	Art/Coll	Roundabout	$900,000	Med.
Canal Blvd	Helmholtz	Art/Coll	Roundabout	$900,000	Med.
Deschutes Mkt Rd	Hamehook	Art/Coll	Roundabout	$900,000	Med.
South Century	Spring River	Art/Coll	Roundabout	$900,000	Med.
Huntington Road	South Century	Collector	Roundabout	$900,000	Low
Northwest Way	Coyner Road	Collector	Turn lanes	$250,000	Low
			Subtotal	**$7,081,250**	

Road Name	From	To	Functional Class	Project	Est. Cost	Rank
County Road Segments, New						
Hunnell Road	Cooley	Rodgers	Collector	New Road	$752,500	High
Cooley Road	18th St	Des Mkt	Arterial	New Road	$653,413	Low
Crooked River Dr	Wilcox	Smith Rock Way	Collector	New Road	$198,000	Low
Unnamed	Masten	6th St	Collector	New Road	$1,485,000	Low
Britta Extension	Britta	US 20	Collector	New Road	$375,000	Low
				Subtotal	**$3,463,913**	
County Road Segments, Existing						
Deer Run Lane	Pinecrest	Huntington	Local	Reconstruct/Pave	$314,820	High
Foster Road	So. Cent.	La Pine Rec	Collector	Reconstruct/Pave	$3,125,000	High
Hunnell Road	Rogers	Tumalo	Collector	Reconstruct/Pave	$2,525,000	High
Huntington	Riverview	Riverview	Future Coll	Reconstruct/Pave	$1,448,575	High
Rickard Road	Groff	US 20	Collector	Reconstruct/Pave	$772,000	High
Canal Blvd	61st/Quarry	Helmholtz	Arterial	Add center turn ln	$508,875	High
Helmholtz	Elkhorn	Maple	Collector	Add travel lanes; center turn lane	$6,132,500	High
Burgess	Day	Huntington	Arterial	Add center lane; widen bridge	$1,084,594	High
5th Street	Amber	State Rec	Collector	Widen/Overlay	$256,250	Med.
17th St	NE Negus	O'Neil Hwy	Collector	Widen/Overlay	$312,500	Med.
W. Antler Ave.	NW 35th	Helmholtz	Collector	Widen/Overlay	$159,375	Med.
N. Canal Blvd	City Limits	US 97	Collector	Widen/Overlay	$434,375	Med.
Gosney Rd	US 20	COID bridge	Collector	Widen/Overlay	$321,875	Med.
Lower Bridge	43rd St	Holmes	Collector	Widen/Overlay	$2,653,125	Med.
Negus Way	City Limits	NE 17th St	Collector	Widen/Overlay	$453,125	Med.
Buckhorn	Lower Br.	OR 126	Collector	Reconstruct/Pave	$1,708,000	Med.
NW Way	Coyner	Maple	Collector	Add travel lanes; center turn lane	$2,923,875	Med.
31st St	Sedgewick	Lower Br.	Arterial	Widen/Overlay	$312,500	Low
35th St	Hemlock	Upas	Collector	Widen/Overlay	$490,625	Low

County Road Segments, Existing						
61st St	S. Canal	US 97	Collector	Widen/Overlay	$665,625	Low
Almeter	NW Way	Sedgewick	Arterial	Widen/Overlay	$165,625	Low
Bailey	US 20	Tumalo Res.	Collector	Widen/Overlay	$306,250	Low
Bear Creek	City Limits	US 20	Collector	Widen/Overlay	$868,250	Low
China Hat	Knott	End main.	Collector	Widen/Overlay	$573,438	Low
Cinder Butte	Baker	Minnetonka	Collector	Widen/Overlay	$440,625	Low
Cooley Road	US 20	OB Riley	Collector	Widen/Overlay	$98,438	Low
Helmholtz	Antler	NW Walnut	Collector	Widen/Overlay	$728,125	Low
Helmholtz	Antler	OR 126	Collector	Widen/Overlay	$156,250	Low
Huntington	So Century	Burgess	Collector	Widen/Overlay	$2,782,500	Low
Obsidian	City Limits	UGB	Collector	Widen/Overlay	$315,625	Low
Smith Rock Wy	US 97	BNSF Xing	Arterial	Widen/Overlay	$96,875	Low
Stevens Road	City Limits	Ward	Collector	Widen/Overlay	$325,000	Low
Tumalo Res.	OB Riley	Collins	Collector	Widen/Overlay	$1,440,625	Low
Wickiup	Helmholtz	SW 58th	Collector	Widen/Overlay	$159,375	Low
Bozeman Trail	Chisolm Tr	Rickard	Local	Reconstruct/Pave	$297,000	Low
Cline Falls	Nutcracker	Nutcracker	Arterial	Disconnect Nutcracker	$75,000	Low
				Subtotal	**$35,432,114**	

Federal Forest Highways						
Road Name	**From**	**To**	**Func. Class**	**Project**	**Est. Cost**	**Rank**
Skyliners	Bend UGB	End Co. Maint.	Collector	Reconstruct/Pave	$11,250,000	High
Burgess	Pringle Falls	So. Century	Collector	Reconstruct/Pave	$4,125,000	Low
				Subtotal	**$15,375,000**	

County Intersections	**$7,081,250**	
County Road Segments, New	**$3,463,913**	
County Road Segments, Existing	**$35,432,114**	
Federal Forest Highways	**$15,375,000**	
Total of County Road Projects	**$61,351,778**	

Highway Intersections					
Highway	**Location**	**Func. Class.**	**Project**	**Est. Cost**	**Rank**
US 20	Cook-OB Riley	Principal Arterial – Art – Collector	Overpass with jug handles	$15,500,000	High
US 97	Lower Bridge	Principal Arterial – Arterial	Grade separation	$21,000,000	Med.
US 97*	Wickiup Jct	Principal Arterial – Arterial	Grade separation, phase I	$30,000,000	Med.
US 97	O'Neill Hwy-Pershall	Principal Arterial – Principal Arterial - Collector	Overpass	$9,500,000	Med.
OR 126	Helmholtz	Principal Arterial – Collector	Traffic Signal	$1,250,000 City of Redmond	Med.
US 97	Quarry Road	Principal Arterial – Local	Grade separation	$15,000,000	Low
US 97	Vandevert	Principal Arterial – Collector	Disconnect Vandevert from 97	$2,300,000	Low
US 20	Hamby-Ward	Principal Arterial – Collector	Roundabout	$1,000,000	Low

Highway Intersections					
Highway	**Location**	**Func. Class.**	**Project**	**Est. Cost**	**Rank**
US 20	Powell Butte Hwy	Principal Arterial – Arterial	Roundabout	$1,000,000	Low
OR 31	US 97	Principal Arterial – Principal Arterial	Turn lanes, then grade separation	$19,000,000	Low
			Subtotal	**$115,550,000**	

Highway Segments						
Highway	**From**	**To**	**Func Class**	**Project**	**Cost Est.**	**Rank**
US 97	11th Av., S	O'Neil Hwy	Princp. Art.	Add travel lanes	$9,000,000	High
US 97	South Century	La Pine State Rec	Princp Art	Add travel lanes	$25,300,000	High
OR 370	US 97	O.5 mi to W	Princp Art	Overpass of RR	$26,100,000	High
US 97	La Pine State Rec	Drafter	Princp Art	Add travel lanes	$11,800,000	Med
US 20	Hawk's Beard	Rail Way	Princp. Art.	Add travel lanes	$20,000,000	Med
US 20	Couch Market	Gerking Mkt	Princp Art	Add travel lanes	$4,900,000	Med
US 20	OB Riley	Cooley	Princp Art	Add travel lanes	$2,400,000	Med
US 20	Providence	Hamby	Princp Art	Add travel lanes	$2,000,000	Med
OR 126	Quail Tree	2 mi to E	Princp Art	Add travel lanes	$7,900,000	Med
OR 126	Cline Falls Hwy	Helmholtz	Princp Art	Add travel lanes	$9,600,000	Med
OR 126	Sherman	Crook Co line	Princp Art	Add travel lanes	$6,100,000	Med
				Subtotal	**$125,100,000**	

Highway Intersections	**$115,550,000**	
Highway Segments	**$125,000,000**	
Total for Highway Projects	**$240,650,000**	

Bike and Pedestrian Projects						
Road	**From**	**To**	**Func Class**	**Project**	**Cost Est.**	**Rank**
--------	Tumalo State Park	Riverview	--------	10' multi-use trail, a/k/a Tumalo Trail	$160,000	High
7th St, Tumalo	US 20	Cook Ave	Collector	5' sidewalks on both sides	$10,625	Med.
4th St, Tumalo	Wood Ave	Bruce Ave	Local	5' sidewalks on both sides	$13,125	Med
5th St, Tumalo	Wood Ave	Cook Ave	Local	5' sidewalks on both sides	$26,250	Med.
5th St, Terrebonne	B Ave	C Ave	Local	5' sidewalk on east side only	$11,250	Med.
C Ave, Terrebonne	6th St	US 97	Local	5' sidewalks on both sides	$45,000	Med.
B Ave, Terrebonne	5th St	6th St	Local	5' sidewalk on north side only	$5,875	Med.
A Ave, Terrebonne	11th St	15th St	Local	5' sidewalks on both sides	$50,000	Med.
Smith Rock Way, Terrebonne	11th St	15th St	Arterial	5' sidewalks on both sides	$50,000	Med.
C Ave, Terrebonne	US 97	16th St	Collector	5' sidewalk on south side only	$38,750	Low

Bike and Pedestrian Projects						
Road	**From**	**To**	**Func Class**	**Project**	**Cost Est.**	**Rank**
11th St S,, Terrebonne	Central Ave	US 97St	Collector	5' sidewalks on both sides	$81,250	Low
11th St S,, Terrebonne	Central Ave	US 97St	Collector	5' sidewalks on both sides	$81,250	Low
8th St, Tumalo	Cook Ave	Riverview	Local	5' sidewalk on both sides	$17,500	Low
Canal "H," Terrebonne	13th St	12th	-------I	10' soft trail	$1,875	Low
Canal "H," Terrebonne	12th St	400' south of A Ave	----------	10' soft trail	$6,875	Low
B Ave, Terrebonne	East end of B at base of plateau	West end of B atop plateau	----------	300' stairwayl	$26,250	Low
4th St, Terrebonne	North end of 4th on ridge	Forster DriveWest	----------	300" stairway	$26,250	Low
				Subtotal	**$570,875**	

County Bridge Projects					
Location	**Sufficiency Rating**	**Posting Required**	**Project**	**Cost Estimate**	**Rank**
Tetherow Rd. at Deschutes River	32.4	Yes	New Bridge	$1,582,500	High
Cascade Lakes Hwy at Fall River	46.6	Yes	New Bridge	$796,250	High
Gribbling Road at Canal	24	Yes	New Bridge	$225,000	Low
Wilcox Ave at Canal	47.2	Yes	New Bridge	$150,000	Low
Sisemore Road at Upper Tumalo Rsrvr	49.1	No	New Bridge	$687,500	Low
			Subtotal	**$3,441,250**	
Transportation System Management (TSM) and Transportation Demand Management (TDM)					
Regional TDM program	Countywide	County share of funding Commute Options at $8K per year		$160,000	High
Regional TDM program	Countywide	Install ride share lots at future locations based on 2011-12 study		$45,000	Medium
			Subtotal	**$215,000**	
			Total for County Road Projects	**$61,352,000**	
			Total for Highway Projects	**240,650,000**	
			Total for Bike/Ped Projects	**$570,875**	
			Total for County Bridge Projects	**$3,441,250**	
			Total for TDM and TSM Projects	**$215,000**	
			GRAND TOTAL FOR ALL PROJECTS	**$306,229,125**	

*Project is within the boundaries of the City of La Pine; however, the City does not yet have a TSP. Once the City of La Pine TSP is completed the project will be removed from the County TSP. The project will not be used in the calculation of the County's transportation System Development Charge (SDC).

Table 5.3.T2

Illustrative List of Unfunded Highway Projects

Highway	Location	Func. Class.	Project	Estimated Cost	Rank
US 97	1.3 mi south of Vandevert	Princ. Art.	Grade separation	$27,000,000	Low
US 97	OR 31	Princ. Art.	Grade separation	$19,000,000	Low
US 20	Old Bend-Redmond	Princ. Art.	Grade separation	$23,000,000	Low
			Subtotal	**$69,000,000**	

The County recognizes timely maintenance is the most financially responsible manner to manage a road system to benefit all modes over the long-run. Besides cars and trucks, bicycles and transit benefit from wider, smoother roadways. Motorists and cyclists will continue to share the roadway in heightened numbers as cycling continues to increase in economic importance in the region. Improved and well-maintained roads assist that blending of those users, resulting in a County road system that is safer and more efficient.

The County's position is that the main purpose of the County-owned road network is to move people and goods as efficiently and safely as possible between and to the incorporated cities in the County, not as a means of increasing urban scale developments in the unincorporated communities of the County. The County recognizes the importance of having a natural and seamless transition of jurisdiction for County roads as they enter urban growth boundaries. The County will also pursue jurisdictional transfers, allowing cities to take over once-County roads as cities expand their UGBs.

Overview of State Highways

The overwhelming majority of deficiencies in the County will occur on the State highway system and where County roads intersect the State system. The major north-south highway on the east side of the State, US 97, will become congested from Crooked River Gorge to Redmond and Sunriver to La Pine. Even the segments of US 97 that are meeting the State's volume/capacity (v/c) ratio will have high enough volumes that they will likely require a raised median for safety reasons. US 20 will fail between Black Butte Ranch and Sisters and in the Tumalo area. OR 126 east and west of Redmond will also not meet ODOT's performance standards.

ARTERIAL AND COLLECTOR ROAD PLAN GOALS AND POLICIES

Goal 4

4. Establish a transportation system, supportive of a geographically distributed and diversified economic base, while also providing a safe, efficient network for residential mobility and tourism.

Policies

4.1. Deschutes County shall:

a. Consider the road network to be the most important and valuable component of the transportation system; and

b. Consider the preservation and maintenance and repair of the County road network to be vital to the continued and future utility of the County's transportation system.

4.2 Deschutes County shall not add any miles of new arterials or collectors to the system unless the following issues are satisfied:

a. The need for the road can be clearly demonstrated;

b. The County can financially absorb the additional maintenance requirements;

c. The condition of the road proposed for acceptance into the County system must meet County road standards;

d. An accrued benefit can be shown to the County's economic growth;

e. The Board determines there have been adequate replacement revenues to off the loss of timber payments from the federal program;

f. An overall increase in efficiency in the County road network can be demonstrated.

4.3 Deschutes County shall make transportation decisions with consideration of land use impacts, including but not limited to, adjacent land use patterns, both existing and planned, and their designated uses and densities.

4.4 Deschutes County shall consider roadway function, classification and capacity as criteria for plan map amendments and zone changes. This shall assure that proposed land uses do not exceed the planned capacity of the transportation system.

4.5 Roads in Deschutes County shall be located, designed and constructed to meet their planned function and provide space for motor vehicle travel and bike and pedestrian facilities where required.

4.6 Deschutes County shall manage the development process to obtain adequate street right-of-way and improvements commensurate with the level and impact of development. New development shall provide traffic impact analysis to assess these impacts and to help determine transportation system needs. The guidelines for traffic impact analysis shall be located within DCC Chapter 17.48. Deschutes County Road Design and Specification Standards.

4.7 Transportation system improvements in Deschutes County shall comply with the Americans with Disabilities Act.

4.8 Transportation safety in Deschutes County shall improve for all modes through approved design practice and sound engineering principles.

4.9 Deschutes County shall acquire the necessary right-of-way through the development process to correct street intersections, substandard road geometry or other problems in order to improve the safety of a road alignment, consistent with constitutional limitations.

4.10 Deschutes County shall support efforts to educate the public regarding hazards related to travel on the transportation system.

4.11 Deschutes County shall support public and private efforts to acquire right-of-way for new secondary access roads to isolated subdivisions.

Future State Highway Projects and Policies

Chapters Three and Four summarized the deficiencies and potential solutions for the ODOT facilities in Deschutes County. As traffic volumes rise and the State highways begin to degrade, ODOT has outlined a policy to improve rural two-lane highways through a "four-phase approach." Deschutes County supports this strategy. The four phases take place incrementally and proceed through the following levels:

1. Addition of passing or climbing lanes
2. Widening to a four-lane section
3. Adding grade-separated interchanges and raised medians
4. Develop full grade-separated interchanges and frontage roads

Through a coordinated analysis effort between ODOT and County staff, the probable locations of future passing and climbing lanes on the state highways in Deschutes County were identified. Also identified were the probable locations of future grade-separated interchanges. The projected highway lane additions and interchanges, shown on Figures 5.2.F1 and 5.2.F2, are in conceptual form. Actual locations and design would be the result of detailed engineering work occurring during project development.

No signals are appropriate on State highways outside of UGBs or in the unincorporated communities of Terrebonne and Tumalo. Drivers on high-speed rural highways do not expect to encounter traffic signals and thus run red lights. In Terrebonne and Tumalo the highway volumes are so high that stopping highway traffic would result in queues on the highway blocking County roads. The queues would thus defeat the purpose of the traffic signal, which is to accommodate side street traffic to cross or enter the highway. Instead, as intersections develop safety or operational problems, they shall be grade-separated, restricted or closed (where there is alternative access). If ODOT chooses to pursue traffic signals in Terrebonne and Tumalo, the agency will need to conclusively demonstrate County roads will not be adversely affected.

The following descriptions identify the roles the state highways are expected to play in Deschutes County over the next 20 years.

US 97

As described in Chapter Two, US 97 is the principal north-south route through Central Oregon, linking Oregon to California and Washington state. The traffic volumes and the sheer number of tractor-trailers attest to the route's primacy. While the highway has been relocated from the centers of Bend and Redmond, US 97 remains the main thoroughfare in Terrebonne and La Pine. The City of La Pine, in the area once known as Wickiup Junction, has the only remaining site in all of Oregon where a Statewide Highway crosses a mainline railroad at-grade. US 97 crosses the BNSF tracks near Burgess Road. Outside of urban areas, a mix of two-, three-, and four-lane sections characterize US 97. (The three-lane sections have passing lanes in one direction only.)

By 2030 the anticipated volumes in the rural areas, as reported in *Technical Memo #3*, will approach:

- 17,600 at the County's north edge;
- 25,000 in Terrebonne;
- 46,300 north of Bend;
- 23,200 south of Sunriver;
- 15,100 by Wickiup Junction; and
- 12,200 by OR 31 at the County's south edge.

The long-term plan to handle these volumes, which are approximately a 33 percent to 50 percent increase over existing volumes, is to make US 97 a divided four-lane highway throughout the County.

Planned improvements for US 97 include $52.8 million in lane additions, $69.6 million in overpasses and grade-separated interchanges, and $80 million to realign US 97 as the second phase of the Wickiup Junction interchange.

There in one location where the four-phased approach will not be followed. Deschutes County and ODOT have agreed US 97 will remain a three-lane cross-section in Terrebonne. The reason is due to significant residential development on both sides of the highway, the elementary school on the west side, commercial development along the flanks of US 97, and the observed high demands to cross the highway. Traffic calming and pedestrian safety are more important than through traffic movement. Improvements to US 97 in the Terrebonne area will focus on non-widening options such as access management, a couplet, traffic signals, or a bypass. The intersection of Lower Bridge Way/US 97 will have either a simple overpass or a grade-separated interchange. The time of delay of driver trying to get through Terrebonne is insignificant to the overall travel time along the corridor.

ODOT and Deschutes County will conduct a refinement plan for Terrebonne based on the goals and objectives of the adopted Terrebonne Community Plan, the goals and objectives of the Oregon Highway Plan, and additional public input and outreach. From a County planning perspective, this is a high-priority project.

In the Redmond area, the three main projects are: (1) addressing O'Neil Junction by adding an overpass over US 97 that disconnects O'Neil Highway and Pershall Way from the highway; (2) determining the southern terminus of Redmond Re-Route Phase II; and (3) developing a conceptual footprint of the US 97/Quarry Road interchange including how Helmholtz Way will connect on the west end.

Between Bend and Redmond the traffic volumes will exceed the threshold ODOT has set for triggering a raised median. The County supports a raised median on US 97, provided an adequate system of frontage road(s) or parallel local alternate routes precede the raised median's installation.

In the Bend area the major issues of ODOT selecting a preferred alternative for US 97 at the north end of Bend (a draft Environmental Impact Statement [EIS] was issued summer 2011). Once a preferred alternative is approved, the County TSP will likely need to be amended. The other Bend area issue is at the opposite end of the City, completion of the Lava Butte project to separate the travel lanes of US 97. The project is due to be completed in 2012 and median barrier is planned for 2015.

The volumes, both current and forecast, are lower between Bend and Klamath County than those from Bend to Redmond. Still, there are capacity issues and safety concerns, particularly in winter. US 97 will ultimately be a divided four-lane facility on the rural lands between Bend and Klamath County. The City of La Pine TSP will address the highway in the urban or urbanizing areas from the Wickiup Junction area south to the end of La Pine.

US 20

US 20 is the principal east-west route through Central Oregon, tying the Mid- and Upper Willamette Valley to the High Desert. The highway sees a fair amount of truck traffic and recreational traffic in both winter and summer. The majority of US 20 is two lanes with the majority of the passing lane sections located between Bend and Sisters; there are a few passing lanes between Sisters and the County line. East of Bend there are passing lanes tied to topography where the highway crosses Horse Ridge.

The 2030 higher volumes will range from 11,900 by Tollgate to 19,200 in the Tumalo area to 15,900 at the east edge of Bend. These are substantially higher than existing (2009) volumes, but less than on US 97. The 2030 volumes will be below ODOT's threshold for a raised median which under Oregon Highway Plan Police 3B is 28,000 ADT. However, US 20 at the western edge of the County does have a history of weather-related crashes in winter, so four-phased improvements will be needed for safety reasons. Policy 3B under Action Item 3B.3 calls for raised medians when the crash rate exceeds the statewide average for similar facilities.

Planned improvements for US 20 include $31.9 million in additional travel lanes and $43.9 for intersection improvements, including overpasses, grade-separated interchanges, and roundabouts. (The County recognizes ODOT has reversed its position while the TSP was being developed, and the agency now has qualms about roundabouts. The County acknowledges ODOT can choose a different form of intersection improvements, but the County will base its financial contribution on a rural roundabout.)

There are two projects proposed for US 20 that drew unfavorable comments from the public. The first is the passing lanes between Black Butte Ranch and Sisters and the second is the long-term improvement at Cook Avenue-OB Riley in Tumalo (see Chapter 4 for a fuller discussion of the relevant issues). The County, ODOT, City of Sisters, and the public attempted to identify mutually agreeable "triggers" for the passing lanes during the public hearings.

Volumes between Sisters and Bend are low enough that no additional lanes are needed except for the segment Couch Market and Gerking Market roads. The lack of parallel local road will make reducing the number of direct driveway accesses onto US 20 a challenge.

In the Bend area, the planned improvements are additional lanes from Providence Drive to Hamby Road and intersection improvements at Old Bend Redmond Highway, Hamby-Ward, and Powell Butte Highway. These are related to traffic increases on both US 20 and the connecting arterial or collector. For Old Bend Redmond ODOT and the County will need to conducts a refinement plan to determine if the solution is a simple overpass or a grade-separated interchange. The crash history at this location is what is driving the improvement as drivers unsuccessfully attempt to cross the highway or turn onto the highway. The County is proposing roundabouts on US 20 at Hamby-Ward and the Powell Butte Highway (see Chapter Four for discussion of the issue).

OR 126

OR 126 passes west to east through Sisters and Redmond and on to Prineville, before connecting to US Highway 26 and on to eastern Oregon. In Deschutes County OR 126 has lower volumes than US 20, reflecting the degree of magnitude in the population difference of Bend and Redmond. In 2009 the volume near Cline Falls, which is the highest on the rural portion, was 8,500 ADT which in 2030 will grow to 18,900. The segment leading to the Deschutes/Crook County line will increase from 7,000 ADT to 16,600.

With the completion of the Cline Falls interchange in 1997, there are few transportation issues remaining or anticipated on this facility in the rural areas. The only improvements needed in 2030 are passing lanes just to the east and west of Redmond and a traffic signal at OR 126 and Helmholtz. Congestion on OR 126 within Redmond will cause drivers to divert to Helmholtz to go south, which will require improvements to Helmholtz and South Canal Boulevard.

As is the case with US 20 between Bend and Sisters, there are really no parallel local roads to provide drivers and cyclists with an alternative to the highway.

OR 31

The Fremont Highway angles through the Basin and Range country to US 395 in Lake County. There are no capacity issues on the highway, including the few miles that lie within Deschutes County. The intersection of US 97/OR 31 does have capacity issues by 2030 as high through volumes on US 97 will thwart drivers on OR 31 wishing to turn left to head south to OR 58 or Klamath Falls. While the ultimate solution would be a grade-separated interchange, separate left and right turn lanes on OR 31 will likely be sufficient for the planning horizon.

OR 27

A scenic route between OR 126 in Prineville and US 20 east of Millican, there are no capacity issues or safety issues. The section in Deschutes County is gravel, but given the ADT there is no reason to pave this District-level highway.

OR 370

The issues on the O'Neil Highway are not about total traffic volume. To the immediate east of US 97 the existing ADT is 1,900 ADT which will become 3,000 ADT by 2030. However, the O'Neil Highway carries a significant amount of truck traffic, particularly from the aggregate sites in western Crook County. Additionally, there are safety problems where the O'Neil Highway, rarely known by its numeric designation of OR 370, intersects US 97.

The flashing yellow beacon will be replaced by a simple overpass, disconnecting the O'Neil Highway from US 97 while simultaneously providing a direct link to Pershall Way on the west side. As part of the overpass project, the Board of County Commissioners will have to approve disconnecting Pershall Way, a County road, from US 97.

The O'Neil Highway has curve restrictions on the Crook County and also just west of US 97 as O'Neil crosses the multiple tracks of the BNSF and the Prineville Railway. A combination of a grade-separation and realignment of the O'Neil Highway will correct the problem.

OR 372

Known as Cascade Lakes Highway, there are no capacity issues on this highway. The state highway ends at Mount Bachelor and the County portion of the road is seasonally closed at the snow gate near Dutchman Flat Sno-Park.

OR 242

No capacity or safety issues; the highway is seasonally closed at the snow gate from October to whenever the snow is finally removed. The McKenzie Highway has opened for vehicular traffic as early as the beginning of May and as late the end of July.

County Roads

The vast majority of the County's arterials and collectors have sufficient capacity to accommodate the forecast 2030 traffic volumes. The following descriptions identify the few segment roles that will require improvement; most of the needs are on the urban fringe.

Baker Road

The segment near the US 97 interchanges climbs from 6,174 ADT to 11,100 ADT. This segment is complicated by proximity to the BNSF tracks and local circulation patterns.

Burgess Road

The section lies to the west of the City of La Pine and requires adding a center turn lane and widening the bridge over the Little Deschutes River.

Canal Boulevard

In the area between 61st Street/Quarry to Helmholtz the ADT changes from a high of 4,910 ADT to 16,500 ADT, necessitating a center turn lane to remove left turns from the travel lanes.

Cline Falls Highway

The improvements are tied to a combination of increased ADT on OR 126 and Cline Falls Highway, both of which result in longer lines of vehicles waiting to enter the highway or the County road. The solution is to disconnect Nutcracker Drive from Cline Falls Highway due to Nutcracker's close proximity to the OR 126 ramps. Nutcracker serves the northern area of Eagle Crest, but there is reasonable alternate access via the main entrance to the resort.

Deschutes Market Road

The update reclassified Deschutes Market back to its original designation of rural arterial. Near Hamehook the existing ADT is 5,592, but in 2030 it is forecast to reach 10,600 for this same area. That future volume, however, is predicated on Cooley Road being extended from 18th Street to Deschutes Market. Until that happens, the proposed rural roundabout at Deschutes Market/Hamehook will not be necessary.

Helmholtz Way

As congestion increases on OR 126 and 5th and 6th streets in downtown Redmond, drivers on the west side of Redmond will begin to increasingly use this north-south corridor. Current volumes on Helmholtz range from 1,188 ADT near Coyner to 2,909 just north of OR 126. The forecast 2030 volumes range from 12,000 near Maple Avenue to 19,700 by OR 126. The growth in traffic and the

need for a viable west side ring road for Redmond means adding travel lanes and a center turn lane from Elkhorn to Maple, a center turn lane from South Canal to Elkhorn, and a rural roundabout at SW Canal.

Northwest Way

The current ADT is 2,244 but in 2030 that becomes 10,800 as Northwest Way is parallel local alternative to US 97 between Redmond and Terrebonne as well as OR 126 and the north edge of Redmond. The planned improvement is to add travel lanes and a center-turn lane between Pershall and Maple Avenue.

Powell Butte Highway

This County arterial provides access to the Bend Airport, US 20, and is a major commuting route between Bend and Prineville. At US 20 the current ADT is 5,346 and in 2030 it will become 7,800 and at the Deschutes/Crook County line the ADT grows from 3,617 to 6,700. While the increase will not require adding capacity to the Powell Butte, the volumes on the Powell Butte and the several intersecting County roads and US 20 will require improvements. The planned improvements will be at Butler Market and Neff-Alfalfa roads as well as the previously discuss rural roundabout at US 20.

South Century Drive

The segment near Spring River Road, which is at the south edge of Sunriver, has a current ADT of nearly 4,500 which by 2030 will become 8,700. Spring River will go from approximately 4,000 ADT to 5,700. The result is the need for a rural roundabout at South Century/Spring River.

Access Management Policies

Roads accommodate two types of travel: local travel and through traffic. Arterial streets are intended for through movement of traffic at higher speeds while local roads are designed to give direct access to the abutting properties. Collector roads provide a link between the local and arterial roads, balancing accessibility and function. Historically, the state and local governments corrected many congestion problems by constructing new bypasses, grade separations or major street improvements. However, such solutions are expensive and are fast becoming infeasible under current funding levels.

Arterial roads without access management can over time become overused for short distance trips and local access to property. Land use changes along these overburdened arterials results in increased trip generation and traffic conflicts, as businesses normally desire to locate on high traffic arterials. The lack of adequate access management and insufficient coordination of land use development, property division and access review can contribute to the deterioration of both the arterial and collector road network. Traffic signals, new road approaches and driveways can decrease speed and capacity, and increase both congestion and hazards. Access management includes the control of vehicular access to major roadways. Partial access control, which is often found on major arterials and highways, is provided by limiting or prohibiting driveway access, left turn movements and cross traffic at intersections. These limitations increase the capacity of an arterial to carry through traffic at the desired speeds without requiring the addition of more travel lanes. Coordination, planning and proper policies can help avoid these problems and costly solutions.

ACCESS MANAGEMENT GOALS AND POLICIES

Goal 5

5. Maintain an access management system adequate to protect the quality and function of the arterial and collector street system.

Policies

5.1 Deschutes County shall designate access and land uses appropriate to the function of a given road.

5.2 Deschutes County shall require new development to minimize direct access points onto arterials and collectors by encouraging the utilization of common driveways.

5.3 Wherever practical, access to state highways shall be provided via frontage roads, alternative local roads or other means, rather than direct access to the highway.

5.4 A non-traversible median on state highways shall be installed by ODOT when operational or safety issues warrant installation as set forth by Policy 3B: Medians in the *Oregon Highway Plan*. Directional breaks in the median may be allowed as needed, provided traffic operations are still safe.

5.5 Access requests onto Deschutes County arterials and collectors for new partitions, subdivisions and commercial and industrial development shall be processed with the following access management classification system in mind:

a. Public road access spaced at no less than every 500 feet on arterials and 300 feet on collectors.

b. If either safety or environmental factors, or the unavailability of adequate distance between access points requires placing access points at lesser intervals, then access shall be denied or the best alternative placement shall be chosen. On road segments that are already severely impacted by numerous access points or on road segments which abut exception areas, adherence to the above standards may be either unreasonable or counterproductive to infill of exception areas. In such cases, these standards may be relaxed by the County Road Department Director to accommodate the aforementioned special conditions.

Functional Classification

Functional classification describes how the public road system should operate. Roads are grouped by their similar characteristics in providing mobility and/or land access. Within the County, there are nine road classifications: primary arterial i.e., State highways, rural arterial, urban arterial, future rural arterial, rural collector, urban collector, future rural collector, forest highway and local road. Continuing coordination is needed between the County and cities in Deschutes County regarding the functional classification of County roads within city limits and urban growth boundaries. The County prefers cities be the road authority and maintain, operate, and plan for all roads within their city limits and UGBs.

Currently, the County maintains approximately 21 miles of roadway within city limits and urban growth boundaries. The County lacks funds to upgrade these roads to city urban standards. Strengthening and revising Urban Growth Management agreements with cities may be an effective way to pursue tight coordination on this important issue and reduce the long-term financial burden to the County. As an example, the County and the City of Bend agreed that as of July 1, 1998, all roads within the Bend UGB will become the responsibility of the City of Bend. This shift reduced the County's urban road mileage by approximately 70% at the time.

The Deschutes County Comprehensive Plan Map will be retained in official replica form as an electronic map layer within the County Geographic Information System and is adopted as part of this Plan.

Bend TSP

The City of Bend is responding to the State's remand of the City's proposed UGB expansion. The City expects to submit a revised proposal by late 2012. Given the uncertainty about which geographic direction the UGB will expand and what the subsequent transportation effects will be, it would be imprudent to amend the Deschutes County TSP at this time for Bend area roads. Once the City of Bend has a formal UGB proposal the County will amend the County's TSP to be consistent with the City's proposal. This will include road improvements, future road corridors, reclassifications, etc.

In the Bend area the County has made reclassifications based on discussions with County and City staff. They are discussed in the County Roads section that follows the City TSP summaries.

Redmond TSP

The 2008 Redmond TSP at Figure 9-1 and Page 9-3 lists a series of functional reclassifications. The following County roads within the Redmond UGB will need to be reclassified in order for the plans to be consistent. The City has major and minor subcategories for arterials and collectors. The County does not have these classifications. The designation of County roads outside of UGBs shall remain consistent with the County functional classes of Rural Arterial and Rural Collector. The County shall require at least a four-foot shoulder bikeway along those sections of road within the County that are extensions of designated Minor Arterials and Major Collectors on the Redmond Plan.

Rural Collector to Rural Arterial:

- Helmholtz Way: (43rd St.) Between NW Maple Avenue and South Canal Boulevard
- Northwest Way: Maple Avenue to future west extension of Pershall Way.
- NW Maple Avenue: between Helmholtz Way (43rd St.) and Northwest Way (27th St.)

Local to Rural Collector:

- Elkhorn Avenue: SW Helmholtz to 39th St.
- NW Spruce: UGB Boundary to Northwest Way

Other Changes:

- Pershall Way: Future Urban Arterial extending west to Helmholtz Way
- Pershall Way: Rural Collector to NW 19th St once Pershall Extension is constructed
- Northwest Way: Future Urban Arterial extending from NW Maple south to NW 27th St
- Northwest Maple: Future Urban Arterial extending west from NW 35th St to NW Helmholtz Way
- Quartz: Show Future Collector extending west from SW 37th St. to Helmholtz Way

Sisters TSP

No changes to existing County roads, no new County roads proposed.

La Pine TSP

The City has not yet begun its TSP planning process. County staff is willing to assist the City once La Pine begins the effort. The chief goal for the County is preparing a Joint Management Agreement (JMA) and having the City take over maintenance of the roads within the City's UGB.

County Roads

Based on conversations with County Planning and Road Department staff; conversations with staff from Bend, La Pine, Redmond, Sisters and ODOT; review of current and future traffic volumes; and the distribution of arterials and collectors the County determined several roads are in need of reclassification. The following roads need to be reclassified.

Rural Collector to Rural Arterial:

- Deschutes Market Road: Bend UGB north to Deschutes Junction interchange
- OB Riley: Cooley Road south to Bend UGB
- Hamby Road: Butler Market Road south to US 20
- Ward Road: US 20 south to Stevens Road

Future Rural Collector to Future Rural Arterial:

- Cooley Road Extension: US 20 west of OB Riley then back east to Glen Vista

Rural Collector added to system the following road that was built since 1998 adoption

- Skyline Ranch Road: Skyliners Road to Century Drive

Other Road Issues

Several rural subdivisions in South County border forests but lack any secondary access. Figures 5.3.F3 through 5.3.F11broadly identify potential solutions. These secondary accesses would be gated and are intended only for emergency evacuations. Due to the swampy terrain several will require bridges. In some cases a dirt road currently exists, but does fall within a dedicated right-of-way or an easement across public land. The emergency secondary access roads or corridors listed in Figures 5.3.F3-F11 are all subject to future engineering and design, rather than specific alignments. They would be built to the County's standard for a 20' foot local road.

Deschutes County functional classification goals and policies are as follows.

FUNCTIONAL CLASSIFICATION GOALS AND POLICIES

Goal 6

6. Designate access and land uses appropriate to the function of a given road.

Policies

6.1 Deschutes County shall:

a. Coordinate the County Transportation System Plan with the transportation system plans of the cities of Bend, La Pine, Redmond and Sisters. The County shall emphasize continuity in the classification of roads and appropriate design standards for roads that link urban areas with rural areas outside the urban growth boundaries. The County and affected city shall agree on the functional classification and design standards of County roads within the proposed UGB area.

b. Request the transfer, or an agreement to transfer with specific timelines and milestones, jurisdiction of County roadways within the urban growth boundaries to their respective cities at the time of annexation. County policy also directs that any developer of property who proposes annexation and who has frontage on a road that does not meet city standards shall have the primary responsibility for upgrading the road to applicable city specifications. Roads shall be upgraded prior to or at the time of annexation, or the developer shall sign an agreement with the city to upgrade the road, at the time of development. Transfer of road jurisdiction shall require the approval of both the County and affected city in accordance with the provisions in ORS 373.270.

c. Future roads outside of city limits but within Urban Growth Boundaries shall have right of dedications sufficient to meet the relevant city standards, but the road shall be constructed to County standards. The County will support a developer who chooses to build the road to the full urban standards of the relevant city instead of to County standard.

d. Coordinate the County Transportation System Plan with surrounding County TSPs.

Road and Street Standards

Historically, County road and street standards and specifications had been located in various places throughout the County Zoning and Subdivision Ordinances, making it a difficult task to implement standards uniformly and update them as needed. In the 1998 TSP the County decided to create a specific section in the development code for road and street standards, thus ensuring they could be modified without requiring an amendment to the Comprehensive Plan.

The County's road and street standards are contained in DCC Chapter 17.48, Design and Construction Specifications and summarized in Table A (roads) and Table B (bike and pedestrian facilities). DCC Chapter 17.48 reflects the County's desire to no longer have urban road standards, only rural road standards, including specific standards for the unincorporated communities of Terrebonne and Tumalo.

ROAD AND STREET STANDARDS GOALS AND POLICIES

Goal 7

7. Update as needed DCC Chapter 17.48, Design and Construction Specifications, to ensure all aspects of construction related to roads, pedestrian walkways and bicycle facilities occurring outside designated urban growth boundaries in Deschutes County are adequate to meet the needs of the traveling public.

Policies

7.1 Any new or reconstructed rural roads shall be built to the standards set forth in DCC Chapter 17.48, Table A. Bicycle and pedestrian facilities shall be built to the standards set forth in DCC Chapter 17.48, Table B.

7.2 Road, pedestrian and bicycle projects occurring in unincorporated areas within urban growth boundaries shall be governed by the respective city's road and street standards. Those requirements shall be coordinated between the city, the County and the applicant during the land use process according to procedures to be identified in the Deschutes County Road Standards and Specifications document.

7.3 Review every three to five years the adopted criteria in DCC 17.16.115 for the requirement of various levels of traffic analysis for each new rural development.

Road Management System

The roads in Deschutes County are maintained with funds from state motor vehicle revenue (gas tax, vehicle registration, and truck tax) and federal forest receipts from timber sales in the Deschutes National Forest. These funds are dedicated for expenditure on roads and restricted by state law to use only on those roads that have been established by the Board of County Commissioners as "County Roads." The Road Department maintains more than 830 miles of County Roads in rural Deschutes County. Of those miles, nearly 700 are paved and almost 140 miles are unpaved.

The Deschutes County Road Department through its pavement management system annually assesses the condition of the County-maintained roads. The Road Department also collects information on traffic volumes on the County system, counting the major roads on average once every two to four years. Through an orderly scheduling of pavement preservation, maintenance, repairs and small-scale improvements, the Road Department attempts to assure the County Road system meets physical standards and Level of Service (LOS) for operations. Deschutes County Road Department crews carry out routine maintenance activities daily and other tasks on a seasonal basis (vegetation control, pothole patching, painting strips on the road, or snow plowing for example). Road sections requiring more extensive work are prioritized with those larger improvements are put out to bid for private contractors to perform (road paving, road construction, turn lanes, traffic signal installations, etc., are examples of work put out to bid).

In addition to County-maintained roads, there are public rights-of-way where the public has the right to drive on the road, but the road is not maintained by any jurisdiction. There are an additional 376 miles of roads in rural Deschutes County that are dedicated to the public, meaning the general public has the right to drive on them, but these roads are not maintained by any government jurisdiction. Known as

"local access roads," they are the maintenance responsibility of the abutting property owners. The traffic volumes are low on these roads, but even at low volumes they present a maintenance challenge for the adjoining property owners. Also as they are public rights-of-way, drivers outside the area can travel on these roads.

Unfortunately, the County's limited resources do not provide adequate funding to improve or maintain these local access roads. Property owners have several options available to maintain or improve their local access road:

- Informally collect money from the area residents and hire a contractor to perform road maintenance
- Form a Special Road District to tax area residents for road maintenance
- Previously, property owners would form a Local Improvement District to then improve the roads to County standards for acceptance into the County-maintained road system. However, following the loss of timber funds, the County in 2006 approved a road moratorium on accepting any new roads into the County-maintained system. In 2009 the Board of County Commissioners approved a revised ordinance that allowed the County to consider collectors and arterials into the County-maintained system, but the moratorium on establishing new local roads into the County-maintained system continues.

ROAD MANAGEMENT SYSTEM GOALS AND POLICIES

Goal 8

8. Maintain the County road network pavement in good to excellent condition.

Policies

8.1 Deschutes County shall continue to maintain and preserve the County road network through its pavement management system which guides a program of paving, repairing, reconstruction, drainage clearance and vegetation control.

8.2 After safety-related issues, the highest volume road segments shall be the next priority for County road maintenance and repair.

8.3 If and when gravel or dirt roads are paved by the County, the main controlling criteria shall be: re-establishment of adequate funding for long-term maintenance, density of surrounding development, traffic volumes, road classification, gap filling, potential school bus routing efficiency and emergency evacuation potential.

Performance Standards

The County and ODOT have adopted performance standards for their respective roads and highways. Deschutes County uses Level of Service (LOS) while ODOT adheres to Volume/Capacity (V/C) ratios. The intent is to set a clear and objective standard to ensure the roads and highways are safe, efficient, and economical. The standards are applied during land use review and when developing improvement projects. The standards also ensure roads and highways are not overbuilt and remain in the appropriate context of their surroundings.

Level of Service (County roads)
Levels of service (LOS) describe the service quality on two-lane roads or highways as determined by average travel speed, percent of time delay due to the inability to pass, roadway capacity utilization, type of terrain (level, rolling, or mountainous) or intersection delay. LOS ratings apply to County roads only.

LOS is defined by a range of designations from "A" to "F". LOS A is completely unimpeded traffic flow while F is highly congested. Table 5.3.T2 identifies the relationship between two-way average daily traffic volumes, level of service and the percentage of daily traffic that occurs during the peak travel hours of the day (K factor). Deschutes County sets a standard of LOS D for existing roads and LOS C for new roads.

While several road segments are expected to reach LOS E by 2030, the overwhelming majority of County roads will be at LOS D or better as long as population growth does not exceed the projections. The projects previously listed in Table 5.3.T1 are intended to return those roads that exceed LOS D back to LOS D or better.

Table 5.3.T3

Deschutes County Roads Maximum Average Daily Traffic by Levels of Service

K Factor	Level of Service				
	A	B	C	D	E
10%	1,700	3,400	5,700	9,600	16,300

PERFORMANCE STANDARDS GOALS AND POLICIES

Goal 9

9. Maintain a level of service of "D" or better during the peak hour throughout the County arterial and collector road system over the next 20 years.

Policy

9.1 Deschutes County shall continue to monitor road volumes on the County arterial and collector network. The County Road Department shall continue to be the department responsible for monitoring volumes and shall strive to count each arterial and collector at least once every four years. The Road Department shall periodically examine the traffic volumes to identify level of service deterioration.

Volume/Capacity ratio (State highways)
While LOS utilizes perceived delay, V/C uses observed traffic volumes divided by the theoretical carrying capacity of a highway segment or intersection. When a County road and a State highway intersect, ODOT's V/C ratio is the controlling performance standard.

ODOT sets the V/C ratio at Table 6 *Oregon Highway Plan* for a highway segment or intersection based on roadside context (urban vs. rural), posted speed, and classification of the highway. The applicable V/C ratios for roads in rural Deschutes County can range from 0.70 V/C to 0.80. Projects listed in Table 5.3.T1 will return segments or intersections forecast to fail in 2030 to acceptable V/C ratios.

Goal 10

10. Maintain the current arterial and collector system in the County and prevent degradation of the capacity of the system.

Policies

10.1 Deschutes County shall monitor County arterials and collectors to help in the determination of when road improvement projects are necessary.

10.2 Deschutes County shall continue to work with the ODOT, the Cities of Bend, La Pine, Redmond and Sisters, and neighboring counties to coordinate solutions to highway and non-highway road issues that cross over jurisdictional boundaries.

10.3 The County shall establish requirements and adopt standards for secondary access roads to isolated rural subdivisions.

Bridges

Deschutes County owns and manages approximately 120 bridges throughout the County. The County Road Department performs routine maintenance and repairs as necessary. Due to structural deficiency several bridges are signed for weight limitations based weight, tractor-trailer combinations, and number of axles.

BRIDGES GOALS AND POLICIES

Goal 11

12. Maintain a safe and efficient network of bridges on County roadways.

Policy

11.1 Deschutes County shall monitor the condition of County bridges on a regular basis, and perform routine maintenance and repair when necessary. The County shall also explore additional funding sources when major reconstruction or replacement of bridges is necessary.

Truck Routes

The *Oregon Highway Plan* designates both US 97 and US 20 as Freight Routes. Both ODOT and the County prohibit trucks from certain highway or roadway segments only due to length of the truck and trailer or selected bridges due to the weight of the load. Oregon is one of the few states that currently allows oversized tractor-trailer vehicles referred to as Longer Combination Vehicles (LCVs) on certain highways. Two types of LCVs, triple trailers and heavier double trailers (105,000-lb weight limit) are allowed to operate in Oregon without a special permit. Truck traffic is generally confined to industrial and commercial areas or surface mines and national forests.

The majority of truck traffic in the County travels on State highways although truck will travel on County and City roads to reach local origin and destinations or USFS roads to timberlands. The County shall continue to designate State highways as the desired through truck routes in the County. Outside of the State highway system, trucks should be limited to travel only on arterial roads unless there is no other reasonable alternative or there is a local origin or destination.

There are federal protocols for designating truck routes based on either cargo (for example, not allowing explosives to be transported through tunnels) or special populations located adjacent or in close proximity to the roadway (schools, convalescent homes for example) or deficiencies in the infrastructure (load-rated bridges or sharp curves, for example). Outside of these limited instances, however, a legal load can travel any State highway or County road.

TRUCK ROUTES GOALS AND POLICIES

Goal 12

12. Develop a plan of designated truck routes on County arterials**.**

Policies

12.1 Deschutes County shall designate that long-haul, through trucks, be limited to operating on Principal Arterial and Rural Arterial roads as designated in the County transportation network, except in emergency situations and when no reasonable alternative arterial road is available for access to commercial or industrial uses.

12.2 Deschutes County shall support economic development by encouraging ODOT to prioritize modernization, preservation, and safety projects on highways designated as Freight Routes over Non-Freight Routes

Facility / Safety Improvements

Deschutes County and ODOT track crashes on their respective facilities. The data include location, time, whether there were fatalities and severity of injuries, type of collision, weather, etc. This information is then utilized to determine appropriate countermeasures to prevent or reduce the number of future crashes based on the crash rate per ADT. A location with very high traffic volumes and a high accident rate may be safer than a location with low volumes but a high accident per average daily trip (ADT) rate. The "high priority" projects in the Project List subsection of this Plan includes improvement projects recommended to improve safety.

FACILITY/SAFETY MANAGEMENT GOALS AND POLICIES

Goal 13

13. Maintain a safe and efficient network of roadways.

Policy

13.1 Deschutes County shall develop and maintain a prioritized inventory of safety-deficient facilities on the County road network and give highest priority to correcting safety issues.

5.4 Public Transportation Plan

As detailed in Chapter 2, several providers offer public transportation services in Deschutes County. Cascades East Transit (CET) offers regularly scheduled services throughout the tri-county area, coordinating schedules with the fixed-route services of Bend Area Transit (BAT). Hawthorne Station at Third Street (Business US 20) and Hawthorne is centroid for CET, BAT, and other public transportation servers.

Central Oregon Intergovernmental Council (COIC) was recently awarded two grants, one is to develop a long-range public transportation plan for Central Oregon and the other is to determine where to expand the region's park and ride lot system. The Bend Metropolitan Organization (BMPO) is starting a long-range transit plan for the MPO. The County will participate on technical and steering committees for these plans. Once the plans determine their final alternatives, the TSP can be amended as needed to incorporate the plans' recommendations.

Both the previously discussed Central Oregon Rail Plan and the COIC public transportation study will also revisit the issue of passenger rail. ODOT's 1992 *Oregon Rail Passenger Plan* determined passenger rail was not cost-effective for Central Oregon. The County will participate in the re-examination of the topic.

PUBLIC TRANSPORTATION PLAN GOALS AND POLICIES

Goal 14

14.1 Enhance the opportunity for intermodal connections throughout the County transportation system, and actively support the provision of public transportation throughout the County.

14.2 Increase the existing level of special services provided.

14.3 Establish rural transit service for Deschutes County residents.

14.4 Decrease barriers to the use of existing public transportation services.

Policies

14.1 Deschutes County shall work with ODOT, the cities of Bend, La Pine, Redmond and Sisters, and transit service providers to study countywide rideshare facility needs, and investigate public transit possibilities including potential transit stops for a regional or commuter-based transit system. Those possibilities shall include bus and rail, and if economically feasible, the County shall seek such services as are found to be safe, efficient, and convenient in serving the transportation needs of the residents of Deschutes County.

14.2 Deschutes County shall continue to work with special service providers, ODOT, and the cities of Bend, La Pine, Redmond and Sisters to secure additional funding as well as increase promotion of those special transit services that may be underutilized.

14.3 Deschutes County shall identify and monitor the needs of the transportation disadvantaged and attempt to fill those needs.

5.5 Bikeway and Pedestrian Plan

Deschutes County recognizes the economic and health benefits of planning for cycling and walking. Many individual riders pedal the County road system and there are numerous organized rides and races that use the County road system. While cyclists can be found on almost any paved County road, pedestrians are primarily concentrated in the unincorporated communities, particularly Terrebonne and Tumalo. Both cyclists and pedestrians can face challenges when trying to cross State highway or higher-volume County roads.

Kreg Lindberg in his "Economic Impact Study: 2009 USA Cycling Cyclocross National Championships, Bend, OR" document the economic effects of two organized events. He found riders, support staff, and spectators spend $1.08 million directly over four days. The same study also reported participants and observers of the 2009 USA Cycling Junior/U23/Elite National Road Race Championships directly spent $1.44 million over a week. Those dollars are then multiplied through the community.

The organized events have had adverse localized effects on rural subdivisions. The County continues to work with the Deschutes County Bicycling and Advisory Committee (BPAC) to ensure area residents, motorist, and cyclists understand one another and the legal rights and responsibilities of all. The County recognizes cyclists are legal users of the road network, but must also obey the rules of the road just as motorists must.

Based on need and road characteristics, all roads open for public use should be considered for the potential to improve bicycling and walking. Facilities should safely accommodate the majority of users. Roads designed to accommodate cyclists with moderate skills will meet the needs of most riders; special consideration should be given close to school areas, where facilities designed specifically for children should be provided. Roads designed to accommodate young, elderly and disabled pedestrians serve all users well.

The *Oregon Bicycle and Pedestrian Plan* provides further guidance regarding accommodating bicyclists and pedestrians on County roads and State highways. All traffic devices used in conjunction with bikeways are required to meet the standards set forth in the national *Manual on Uniform Traffic Control Devices* (MUTCD).

Rural Bikeways

The rural roads in Deschutes County, except for the urban fringe, tend to have low traffic volumes and the intersections of public streets or driveways are spaced much farther apart than found in cities. Terrebonne and Tumalo have a denser road network with more connections. Therefore on most rural roadways, shoulder bikeways are appropriate as they accommodate cyclists. The County's minimum shoulder widths in Table A and the bike and sidewalk requirements in Table B ensure adequate shoulder widths to make County arterials and collectors suitable for bicycle travel. See Tables 2.2.T10-T12 for County shoulder standards for rural roads and roads within Terrebonne and Tumalo. See Table 2.2T15 for the County's specific bikeway design standards.

The County has designated a system of County bikeways on selected arterials based on coordination with BPAC, Bend, La Pine, Redmond, Sisters, and the Road Department. Additionally, the County in coordination with Sen. Ron Wyden, D-OR, has worked to develop a series of loop rides that would merit inclusion in the State's scenic bikeway program. The loops are known as the "Three Sisters

Scenic Bikeway" and are displayed at Figure 5.5.F1. For the designated County bikeways, see the Figures 5.5.F2-F5.

Shared roadways are adequate on low-volume rural roads, where motor vehicle drivers can safely pass bicyclists due to the low likelihood of encountering on-coming traffic. Shoulder bikeways can be added to roads with high bicycle use, such as in semi-rural residential areas or close to urban areas. It may be appropriate to stripe and mark shoulders as bike lanes near schools or other areas of high use. Even adding minimal-width shoulders can improve conditions for bicyclists on roads with moderate traffic volumes. On roads with high use, it may be necessary to add full-width shoulders in areas of poor visibility due to topography.

The County has also changed the way it applies chip sealing to accommodate cyclists. The County has gone to a smaller rock (3/8") which is also washed and sealed. The County only chip seals the travel lanes, not the shoulders. This should address the cyclists' concerns about having an acceptable riding surface.

Rural Walkways

In sparsely populated areas, the shoulders of rural roads usually accommodate pedestrians. Roadways in unincorporated communities such as US 97 in Terrebonne or Cook Avenue in Tumalo have existing or developing urban roadside character that creates the needs for sidewalks. Both communities have higher density residential patterns more characteristic of a small town and a recognizable commercial core. In Terrebonne's case, US 97 and 11th Street define the community's core, whereas Cook Avenue forms the spine of Tumalo's core. Figure 5.5.F6 deals with Terrebonne while Figure 5.5.F7 focuses on Tumalo.

How and where pedestrians cross State highways and major County roads is potentially more important than pedestrian travel along those roads. Traffic volumes will dictate at what locations special pedestrian treatments may be warranted. It is anticipated that much of the focus will be on the State highways as they travel through rural communities. These locations have the highest concentrations of pedestrians and activity centers. Pedestrian treatments will be analyzed in concert with traffic calming strategies on the highways. Raised medians wide enough to afford a pedestrian refuge, bulb outs, textured crosswalks, and similar pedestrian enhancements are appropriate tools. Where sidewalks are not provided, paved shoulders should be wide enough to accommodate both pedestrians and bicyclists. Paved multi-use paths provided on one or both sides of a roadway in a rural community may be appropriate for providing access to schools. These paths will also serve the needs of young bicycle riders.

Through the site plan review process, the County shall continue to monitor pedestrian facility design, and require appropriate facility designs to comply with provisions of the Americans with Disabilities Act (ADA).

This Plan identifies policies, bike and pedestrian facility classifications, design standards and construction and maintenance guidelines. Many of the design standards apply to urban rather than rural areas. However, they are in this plan because they may apply to specific projects, new neighborhoods, or urban unincorporated communities. This TSP contains a list of suggested improvements on the Deschutes County Road System to accommodate bike and pedestrian facilities. Completion of these projects will considerably enhance the network of bike and pedestrian facilities throughout the County.

While Deschutes County does not have a Parks Department nor does the Road Department have the equipment, staffing, or expertise to build or maintain trails, the County supports the development of a trail system. The County would support grant applications by third parties to build and maintain trails, particularly for the following:

- Tumalo Trail on the west bank of the Deschutes River between Tumalo State Park and the unincorporated community of Tumalo
- Bend to Smith Rock State Park along the Trans-Canada pipeline and other applicable ditch rider road
- Redmond to Smith Rock State Park across County-owned land
- Bend to Sisters along the old Brooks-Scanlon logging road
- South Deschutes County to Bend, with connections to Sisters, Redmond and Smith Rock State Park.

See Figures F5.5.F8 and F5.5.F9 for the Bend area trails and the Bend-Redmond trails.

On-Road Route Selection

The integrity and usefulness of the bicycle system mandates that future development is designed with bicycling in mind. The County will strive to provide a road system that allows cyclists the ability to easily travel between communities and minimizes out-of-direction travel.

Off-Road Route Selection

On-road bike facilities including shoulder bikeways and bike lanes are generally preferred by more experienced cyclists and can have a lower initial construction cost; maintenance can be included with the adjacent roadway. However, paved and unpaved off-road bike paths can cater more to the recreational and fitness riders, and also offer a mostly automobile-free route for cyclists who are either inexperienced, younger, or older; essentially these riders feel more comfortable riding with no or few automobiles present. Well-placed paths could also serve commuting cyclists; these routes or paths have the most potential when they serve origins and destinations effectively. Designing off-road trails to connect urban trails with rural trails is often a challenge. A paved multi-use path should meet ODOT guidelines and be of sufficient width to accommodate multiple user types (e.g. cyclists, walkers, strollers, etc.). The opportunity exists in Deschutes County to create off-road, separate multiple-use paths in several circumstances, including but not limited to:

- Along irrigation district maintenance "ditch rider" roads adjacent to irrigation canals.
- Major utility easements.
- Short connector routes between adjoining subdivisions, and between subdivisions and adjoining commercial areas, schools, parks, public lands, and between rural and urban trail systems.
- Abandoned roadways and rail lines.
- Additional bicycle paths within destination resorts and new recreational communities now in the planning stage.
- Heavily used and impacted forest trails that could benefit from the additional armoring that a widened pavement surface provides.

Bike Facility Requirements

The TPR has various requirements relating to bicycle facilities such as bike parking amounts and areas, and employee considerations such as shower and changing facilities. These requirements have already been implemented through Deschutes County ordinances, but are reinforced here with goals and policies.

BIKEWAY AND PEDESTRIAN PLAN GOALS AND POLICIES

Goal

15.1 Review every three to five years the adopted Countywide system plan for bike and pedestrian facilities to ensure continued access to various destinations within unincorporated communities and between urban areas and unincorporated communities.

15.2 Provide and maintain a safe, convenient and economical bicycle and pedestrian system that is integrated with other transportation systems.

15.3 Support bicycle safety, education and enforcement programs for all ages, improve riding skills, achieve observances of traffic laws, increased awareness of cyclists and pedestrians' rights, and monitor and analyze bicycle accident data to determine safety problem areas.

15.4 Coordinate on-road County bikeways with known existing and proposed state and city bikeways.

15.5 Work with BPAC to identify a system of off-road paved and non-paved shared-use paths to be included in the County transportation system.

15.6 Maintain the existing development requirements for bicycle facilities in Deschutes County.

Policies

15.1 Deschutes County shall coordinate local plans for pedestrian and bicycle facilities with the most current edition of the *Oregon Bicycle and Pedestrian Plan.* The statewide plan provides a framework for a local bicycle and pedestrian system and design standards.

15.2 Deschutes County shall require bike facilities at locations that provide access within and between residential subdivisions, schools, shopping centers, industrial parks, and other activity centers when financially feasible.

15.3 Deschutes County shall:

a. Balance the plan with a variety of facilities to meet the needs of different cyclists;

b Plan for bicycle access between the County's urban and rural areas;

c. Develop a bikeway system, to be updated semi-annually and including a map for the public that describes the opportunities for bicycling in Deschutes County;

d. Establish priorities for facility construction and maintenance based on need and resource availability;

e. Evaluate the plan regularly to monitor how well the facilities meet the goals of the Plan;

f. Upgrade rural road shoulder widths to County standards during road modernization or maintenance projects involving overlays as funding allows, provided no additional purchase of right-of-way is required or substantial cut and fill or grading is needed;

g. Require bicycle and pedestrian facilities to satisfy the recreational and utilitarian needs of the citizens of Deschutes County;

h. Make potential use, safety and the cost of bikeway construction, the primary considerations when designing specific bikeways;

i. Emphasize the designation of on-road bikeways, where conditions warrant due to safety reasons and the cost of construction and maintenance of separate bike paths;

j. Expend resources for the maintenance of existing bikeways and to keep pace with the development of new bikeways;

k. Designate that the Deschutes County Bicycle and Pedestrian Advisory Committee facilitate the coordination of all bicycle and pedestrian planning in the County to assure compatibility;

l. Designate that the Deschutes County Bicycle and Pedestrian Advisory Committee assure that the Plan remains up-to-date and that implementation proceeds according to the Plan;

m. Work with affected jurisdictions to acquire, develop, connect, and maintain a series of trails along the Deschutes River, Tumalo Creek, and the major irrigation canals so that these features can be retained as a community asset;

n. Adopt standards for trail system right-of-ways and trail improvements that are based on the type of planned trail use and reflect the standards of the most recent version of the *Oregon Bicycle and Pedestrian Plan*;

o. Pursue grant opportunities to plan or construct the Tumalo Trail between Tumalo State Park and the unincorporated community of Tumalo;

p. Work cooperatively with City parks and recreation districts to support grant applications to build or maintain trails in the rural County whether on public or private lands; and

q. Support the implementation of the Three Sisters Scenic Bikeway plan.

15.4 New public and private land developments in Deschutes County shall accommodate and tie into the bicycle system, and shall provide their residents and employees with appropriate bicycle facilities.

15.5. County arterials and collectors may use shoulder bikeways or shared roadways. These bikeways shall be upgraded to bike lanes when highway reconstruction occurs and the traffic volumes warrant lanes.

15.6 Deschutes County shall facilitate safe and direct bicycle and pedestrian crossings of arterial roads.

15.7 On-road bikeways shall be constructed in accordance with the specifications set forth in DCC Chapter 17.48, Table A.

15.8 Developers in Deschutes County shall be encouraged to design paths that connect to the countywide bikeway system and that provide the most direct route for commuters. In some cases, it may be appropriate to relax a requirement, such as for a sidewalk on one side of a residential street, in favor of a comparable and relatively parallel bike path within the development. However, the developer's provision of a bike path shall not change the on-road bikeway requirement for arterials and collectors.

15.9 Deschutes County shall facilitate the development of mountain bike routes and the creation of paved off-road shared-use paths. The County shall work with its public agency and non-profit partners and the County Bicycle and Pedestrian Advisory Committee (BPAC) to identify such routes and incorporate them into its transportation system where appropriate. Particular attention shall be given to obtaining and keeping rights-of-way for uninterrupted routes linking various residential, commercial, resort, and park areas within the County. Linear corridors such as rivers, irrigation canals, ridges and abandoned roadway and rail lines shall receive special attention. Proposed developments may be required to provide such identified trail and path rights-of-way as part of their transportation scheme in order to maintain the integrity and continuity of the Countywide system.

15.10 The County shall work with local agencies, jurisdictions, and affected property owners to acquire, develop, address trail-connectivity issues and maintain only those sections of trail that are located outside of UGBs that are consistent with the County's TSP, but are part of a trail plan or map that has been adopted by the local jurisdiction and/or the County. Staff will work with local, state, federal agencies, and BPAC to determine the priority for trails that connect urban and rural areas.

15.11 Off-road paved shared-use paths shall be constructed in accordance with the guidelines set forth in the most current edition of the *Oregon Bicycle and Pedestrian Plan*.

15.12 Deschutes County shall maintain and update as necessary, the existing ordinance requirements for bicycle facilities found in DCC 18.116.031 and DCC Chapter 17.48, Table B, or such other location that it may be moved to within the Deschutes County Development Code.

5.6 Airport Plan

Airport Overview

The continued operation and vitality of airports registered, licensed or otherwise recognized by the Department of Transportation is a matter of State and County concern. The County protects the operations of airports through the Airport Safety Combing Zone (DCC Chapter 18. 80) to ensure safe operations of aircraft and that nearby land uses are compatible. DCC Title 18 also requires the Federal Aviation Administration (FAA) be notified of land use applications within the AS zone.

There are currently 18 registered airports in Deschutes County. Four of these are public use airports; two of which, Bend Municipal and Redmond Municipal-Roberts Field are publicly owned while Sisters Eagle Air and Sunriver airports are privately owned. These airports have improved (paved) runways, and offer a range of services, from the availability of commercial passenger flights arriving and departing daily at Redmond Municipal Airport, to the Sisters (Eagle Air) Airport which offers no services or runway navigational aids. Cline Falls Airport, Juniper Airpark and Pilot Butte Airport are privately owned private use airports with more than three based aircraft. There are three heliports: St. Charles Medical Center, La Pine and Cinder Butte, all with fewer than three based aircraft. The eight remaining airfields; Don Stevenson Ranch, Fall River Fish Hatchery, Gopher Gulch, Pine Ridge Ranch, The Citadel, Whippet Field, Freight Wagon and Sage Ranch Airports are all privately owned, private use airfields with 2 or fewer based aircraft.

The Redmond Airport Master Plan will guide the future use of the airport in terms of runway and terminal expansions as well as operational decisions. Similarly, the Bend Airport Master Plan, which is currently being updated, will detail the future of that airport. Land uses at the Bend Airport must go through the Deschutes County land use process. The County and the City have continued to ensure adjacent residents have been involved in the Bend Airport Master Plan update in order to incorporate and address their concerns about airport operations, particularly noise. No changes or expansions to the Sisters and Sunriver airports are envisioned at this time, although planning staff occasionally meets with Sisters airport owners and representatives, including City of Sisters staff, about different improvement options for that facility. At some point, the Sisters airport may need to develop its own airport master plan and seek inclusion in the Sisters UGB.

The possibility of a new public general aviation airport located in the South County has been discussed and analyzed in a March 2002 feasibility study. The airport would be funded by private interests and the site most often mentioned, south of Rosland Road between US 97 and the BNSF railroad, would lie within the City of La Pine. The proposed Bird Field would thus require land use decisions by the City of La Pine, not Deschutes County, and would need to comply with the Oregon Department of Aviation's requirements for establishing a new airport. See Oregon Administrative Rule (OAR) 738-020-0025 and OAR 660-013 for further information.

AIRPORT PLAN GOALS AND POLICIES

Goal 16

16. Protect the function and economic viability of the existing public-use airports, while ensuring public safety and compatibility between the airport uses and surrounding land uses for public use airports and for private airports with three or more based aircraft.

Policies

16.1. Deschutes County shall protect public-use airports through the development of airport land use regulations. Efforts shall be made to regulate the land uses in designated areas surrounding the Redmond, Bend, Sunriver and Sisters (Eagle Air) airports based upon adopted airport master plans or evidence of each airports specific level of risk and usage. The purpose of these regulations shall be to prevent the installation of airspace obstructions, additional airport hazards, and ensure the safety of the public and guide compatible land use. For the safety of those on the ground, only limited uses shall be allowed in specific noise impacted and crash hazard areas that have been identified for each specific airport.

Continuing the protection of the privately owned, private-use airports, with three or more based aircraft, is also accomplished by the AS overlay zone. AS also protects the function and economic vitality of privately owned, private-use airports with two or fewer based aircraft. Each airport's specific level of risk and usage shall be used to guide the continued safe aeronautical access to and from these airports considering the type of aircraft approved to use the airfield.

16.2 Deschutes County shall:

a. Continue to recognize the Redmond (Roberts Field) Airport as the major commercial/passenger aviation facility in Deschutes County and an airport of regional significance. Its operation, free from conflicting land uses, is in the best interests of the citizens of Deschutes County. Incompatible land uses shall be prohibited on the County lands adjacent to the airport;

b. Cooperate with the cities of Bend, Redmond and Sisters in establishing uniform zoning standards, which shall prevent the development of hazardous structures and incompatible land uses around airports;

c. Take steps to ensure that any proposed uses shall not impact airborne aircraft because of height of structures, smoke, glare, lights which shine upward, radio interference from transmissions or any water impoundments or sanitary landfills which would create potential hazards from waterfowl to airborne aircraft;

d. Allow land uses around public-use airports that shall not be adversely affected by noise and safety problems and shall be compatible with the airports and their operations;

e. Work with, and encourage airport sponsors to work with the Federal Aviation Administration (FAA) to enforce FAA-registered flight patterns and FAA flight behavior regulations to protect the interests of County residents living near airports.

f. Adopt regulations to ensure that developments in the airport approach areas shall not be visually distracting, create electrical interference or cause other safety problems for aircraft or persons on the ground. In addition, efforts shall be made to minimize population densities and prohibit places of public assembly in the approach areas;

g. Continue efforts to prevent additional residential encroachment within critical noise contours or safety areas without informed consent;

h. Specifically designate any proposed airport facility relocations or expansions within County jurisdiction on an airport master plan or airport layout plan map, as amended, and establish the appropriate airport zoning designation to assure a compatible association of airport growth with surrounding urban or rural development;

i. Maintain geographic information system (GIS) mapping of the Airport Overlay Zones and provide timely updates;

j. For those airports in Deschutes County without adopted master plans, the County shall, as a minimum, base any land use decisions involving airports on DCC Chapter 18.80 and Oregon Administrative Rule Chapter 660, Division 13, Airport Planning;

k. Participate in and encourage the County-adoption of airport master plans for all public use airports and at least an airport layout plan for the remaining State-recognized airfields in Deschutes County;

l. Encourage appropriate federal, state and local funding for airport improvements at public-owned airports; and

m. Discourage future development of private landing fields when they are in proximity to one another, near other public airports and potential airspace conflicts have been determined to exist by the Federal Aviation administration (FAA) or the Oregon Department of Aviation.

5.7 Rail Plan

A trio of railroad issues predominates planning for rail in the region: safety of existing at-grade rail crossings, access to the national freight rail system, and the potential of passenger rail service. The Central Oregon Area Commission on Transportation (COACT) conducted a study in 2009 that analyzed all three issues. Additionally, ODOT issued a statewide Rail Study in 2010 to augment the agency's Oregon Rail Plan (2001) and Oregon Passenger Rail Plan and Policy (1992). The presence of a viable rail network could extend the capacity of State highways by shifting freight from trucks to rail or by having rail haul trailers to distribution points. Passenger rail could perform a similar function by serving commuters in the Madras-La Pine corridor. Rail offers an alternative to road construction to reduce highway congestion and simultaneously provide freight and passenger mobility.

Rural Deschutes County has nine (9) existing at-grade rail crossings, listed from north to south:

- NW Eby/NE 9th (Terrebonne)
- Smith Rock Way (Terrebonne)
- NE O'Neil Highway (just north of Redmond)
- Baker Road (south edge of Bend)
- Benham Falls Road (north edge of Sunriver)
- Vandevert Road (south of Sunriver)
- State Rec Road (between Sunriver and La Pine)
- Prairie Road (between Sunriver and La Pine)
- Pinecrest Drive (north of La Pine)

Based on functional classification of the surface street, daily traffic volumes, and topography, the COACT study ranked all 41 at-grade crossings in the tri-county area in terms of high, medium, and low for closing or grade-separating. The study ranked seven at-grade crossings rated as high in Crook, Deschutes, and Jefferson counties. Within Deschutes County, the study ranked two at-grade crossings as high, NE O'Neil Highway and Baker Road. The goal is to grade separate at least five of the seven at-grade crossings ranked as high by 2029.

The City of Prineville Railway (CoPR) is a short-line railroad that accesses the mainline tracks used by Burlington Northern and Union Pacific. Prineville Junction is a railroad wye to the immediate east of O'Neil Junction where US 97, O'Neil Highway, and Pershall Way intersect. The Prineville Junction site offers incredible potential as a multimodal site or a reload location (trucks to freight cars or vice versa) due to its proximity to US 97 and Redmond's current east side arterial network and future west side ring road. While the BNSF and UP prefer to run large unit trains with single cargos for long distances such as Portland-Los Angeles, the "hook and haul" approach works against rail-dependent economic development in Central Oregon.

The CoPR's strength is its ability to collect and distribute small loads from local shippers to the BNSF network. The COACT Rail Plan's intent is to have the CoPR assemble enough local freight at Prineville Junction that BNSF would provide regular freight service to the region. Rail is a vital component for industries that deal in or produce large volume, large weight, but lower value goods. Rail is the best mode to move such goods for intermediate to longer ton-miles (cost to move 2,000 pounds or one ton for a distance of one mile).

While historically passenger trains served the area for decades, currently the closest passenger rail service is the Amtrak depot in Chemult with connecting bus service to Bend. Several ODOT studies,

including the 2010 Rail Plan, have examined the possibility of passenger rail. The Central Oregon Intergovernmental Council (COIC) is going to add to that bibliography in the next two years as COIC examines public transportation options, including passenger rail. Central Oregon's relatively small population and low population density make passenger rail problematic during the next 20 years.

RAIL PLAN GOALS AND POLICIES

Goal 17

17.1 Maintain the existing levels of freight rail activity throughout the County while also encouraging expanded usage by commercial and industrial companies.

17.2 Increase the safety of existing at-grade crossings and work towards the eventual replacement of all at-grade crossings with gate-protected or grade-separated crossings according to the prioritized list from the 2009 *Report on Central Oregon Rail Planning*

17.3 Re-establish passenger rail service to Central Oregon as soon as practical

Policies

17.1 Deschutes County shall:

a. Work cooperatively with affected local jurisdictions and railroad operators to reduce land use conflicts and increase safety at all at-grade crossings;

b. Encourage efforts to improve the condition of rail lines throughout the County in order to retain the effectiveness and competitiveness of freight rail;

c. Not endorse the abandonment of any rail lines unless they are to be converted to trail use through the federal "Rails to Trails" program. Once converted, the trails shall be incorporated into the County Bikeway/Trail System;

d. Not endorse any activities that would diminish existing rail service; and

e. Work cooperatively with affected local jurisdictions, businesses and railroad operators to protect all rail spurs that currently serve businesses or have the potential to serve freight rail uses from abandonment or incompatible zoning.

17.2 Deschutes County shall work cooperatively with ODOT, area cities, and rail providers to identify and prioritize the actions needed to provide passenger rail service on the US 97 corridor.

5.8 Water Plan

A water-borne transportation plan is not applicable in Deschutes County.

5.9 Pipeline Plan

Many miles of pipeline in Deschutes County currently carry power transmission lines, cable television, telephone, natural gas, water and sewage. The County encourages the continued use of pipelines to carry goods across County boundaries and for distribution within the County.

5.10 Transportation System Management (TSM) and Transportation Demand Management (TDM) Plans

Although not urban lands, Deschutes County still has the potential to use several TSM and TDM strategies in order to help preserve the function of major County roads and state highways. The TDM strategies can also be utilized by employers whose businesses occupy rural lands.

Transportation System Management (TSM)

TSM improvements focus on optimizing the carrying capacity of roads by alleviating congestion and reducing accidents. Examples of TSM strategies include:

- Minimizing the number of access points
- Channelization of turning movements
- Creation of continuous turning and merging lanes
- Raised medians
- Signalization

An important aspect of TSM is that public agencies work closely with affected businesses to fully evaluate impacts from changes to access. In addition, TSM must account equally for the needs of all modes of travel, particularly that bike, pedestrian and transit movements and safety are not compromised in exchange for improving roadway capacity.

Transportation Demand Management (TDM)

Unlike TSM strategies, which focus on physical changes, TDM targets driver behavior, mode choice and employers to lower the traffic demands on the roads, especially during the peak travel times of the day. Examples of TDM strategies include:

- Alternative or flexible work schedules
- Ridesharing/carpooling
- Transit use
- Bicycling/walking
- Parking management
- Working at home/telecommuting (teleworking)

TDM strategies often involve and education and promotion effort to encourage changes in single occupant driving behavior. Therefore, TDM strategies require a concerted community and/or employer effort and commitment to realize the greatest results. Also significant is that, of all the different strategies used to relieve congestion, TDM efforts in Bend, La Pine, Redmond, Sisters, Prineville, and

Madras can all affect the County and each city because of the employee commute patterns throughout the tri-county area.

TRANSPORTATION SYSTEM AND TRANSPORTATION DEMAND MANAGEMENT GOALS AND POLICIES

Goal 18

18.1 In order to optimize the carrying capacity of the County road system, provide cost effective transportation improvements and implement strategies that shall improve the efficiency and function of existing roads.

18.2. Reduce peak hour traffic volumes on County roads and diminish the exclusive use of single-occupant vehicles.

Policies

18.1. Deschutes County shall adopt land use regulations to limit the location and number of driveways and access points on all collector and arterial roads;

18.2 Deschutes County shall ensure that land use actions support the access management policies of the Oregon Department of Transportation (ODOT) along State highways.

18.3 Deschutes County shall implement transportation system management measures to increase safety and reduce traffic congestion on arterial and collector streets, and protect the function of all travel modes.

18.4. Deschutes County shall promote safety and uninterrupted traffic flow along arterials via the following planning considerations:

a. Clustering of all types of development and provisions for an internal traffic circulation pattern with limited arterial access shall be encouraged;

b. A minimum setback of 50 feet from arterial rights-of-way shall be required;

c. Recommendations on speed limits shall be forwarded to the State Speed Control Board.

18.5 Deschutes County shall:

a. Encourage businesses to participate in transportation demand management efforts through the development of incentives and/or disincentives. These programs shall be designed to reduce peak hour traffic volumes by encouraging ridesharing, cycling, walking, telecommuting, alternative/flexible work schedules and transit use when it becomes available;

b. Work with business groups, large employers and school districts to develop and implement transportation demand management programs;

c. Continue to support the work of non-profit agencies working towards the same TDM goals as Deschutes County;

d. Encourage programs such as van or carpooling (rideshare) to increase vehicle occupancy and reduce unnecessary single-occupant vehicle travel;

e. Continue to pursue the development of park and ride facilities and consider the siting of a rideshare facility, based on identified needs, when realigning County roadways, considering the sale of surplus property, or reviewing land use applications for developments that could benefit from such a facility;

f. Pursue the development and utilization of telecommunication technologies that facilitate the movement of information and data;

g. Support efforts to educate the public regarding the actual costs related to travel on the transportation system and encourage transportation demand management alternatives; and

h. Establish and make available a transportation demand management program to County employees, to serve as a role model for the community.

CHAPTER SIX

TRANSPORTATION FINANCE PLAN

The Plan must balance identified deficiencies, and gaps with the ability to fund improvements to mitigate those needs. The County, along with the State and Federal governments, faces unprecedented funding shortfalls. The County must utilize a wide array of financial strategies to fund these improvements.

6.1 Current Funding Sources

The Road Department has the responsibility to design, build, and maintain County roads. The Road Department must budget for all these tasks; increases in the cost of one area means less money to spend in another. Another ripple effect is a decline in revenues means less funding for all tasks. A perfect financial storm that began in 2007 continues to buffet the Road Department: the cost of road materials is increasing; vehicles are more fuel efficient or use alternative fuels which results in less revenues to the Road Department; federal timber funds that historically accounted for approximately 8 to 13 of the department's budget are disappearing; and people are driving less due to the flattening of the national and regional economies or are not buying vehicles, which again results in less revenue .

In 2007 the Board approved a varied approach to stanch the red ink. The strategy resulted in the following changes:

- Raised the solid waste tipping fee by $5 a ton, dedicating the revenues to road maintenance
- Created a countywide transportation System Development Charge (SDC)

Voters in 2008 defeated an option to increase the Transient Lodging Tax (TLT) from 7% to 9% to fund maintenance on roads with high tourist use (Cascade Lakes Highway, for example). Due to the ailing economy, neither the SDC nor the tipping fee has brought in the expected revenues. As construction fell off, so did trips to Knott Landfill to dump debris and materials. Land use applications fell to historic lows.

The Road Department needs approximately $5 million annually to fully fund preservation and overlay work. The end result of the economic downturn is the Road Department faces an annual gap of $3 million for funding full road maintenance over the next 20 years. Full road maintenance means all County arterials and collectors are overlaid during the next 20 years and no paved County road falls below a Pavement Condition Index (PCI) of 70. A PCI of 70 is the boundary between good and fair condition for pavement.

The State and Federal governments are also experiencing shortfalls. These two entities typically have funded the majority of road modernization projects. Gas taxes account for 40 percent of the State Highway Trust Fund.

Historically, the County Road Department has had the responsibility to propose projects, acquire funding, schedule improvements and construct or contract for the construction of transportation projects in the County. Each year, the Road Department has submitted a list of prioritized projects called the Major Roads Capital Improvement Program (MRCIP) to the County Board of Commissioners for approval. The TSP augments the existing MRCIP process by providing a long-term project listing along with the short-term plan in the MRCIP. In the past, the MRCIP has contained five years' worth of projects. The MRCIP shall continue to be updated and adopted by the County Board of Commissioners

each year but it will now only contain three years' worth of projects. The MRCIP could also form the basis for a special bond measure discussed below. Traditionally, funding for local and state roadway improvements has come from the variety of sources including:

Federal Sources:

- Revenue from timber sales on federal lands within Deschutes County
- Secure Rural Schools Act (programmed to diminish every year before disappearing in 2012)
- Grants

State Sources:

- Vehicle registration fees
- State gas tax
- Weight mile fees
- Grants

County Sources:

- System Development Charge (SDC) funds

In the most recent fiscal year, the Road Department had total revenues of $14.4 million with motor vehicle revenue providing $11.3 million or 79 percent. Forest receipts comprised $1.3 million or 9 percent. By contrast, the Solid Waste tipping fee brought in $285,773 or 2 percent and the transportation SDC garnered $250,000 or 2 percent. Clearly, the Road Department needs a diversified source of funding.

In summer 2011 the Board reconvened the advisory committee that worked on the statewide County SDC and added a few additional members. The Board tasked the committee to look at the funding issue for County road maintenance and develop recommendations for the Board. The Road Study Committee expects to have those recommendations by late 2011 to early 2012. The group will look at everything from the road standards themselves to the Road Department's organization to allowing selected local roads return to gravel. While the committee will focus on funding road maintenance, there is a benefit to modernization and safety projects. Finding ways to either increase funding for road maintenance or decrease the amount needed to be spent on maintenance, means dollars could then be reallocated to modernization or other improvement projects.

6.2 Improvement Costs

When looking at the County road budget, an important consideration is the allocation of funds for maintenance projects within the cities, UGBs and the rural area. Current funds have been flexible as to how they are spent. The mix of maintenance operations versus capital projects is largely a policy issue, which could vary from year to year. Historically, the County has been responsible for maintaining (asphalt overlays, plowing, etc.) roads within city limits and UGBs. Bend maintains all roads within the UGB, but the County assists when requested. The cities of Redmond and Sisters have taken over responsibility as annexation has occurred. Ideally, all roads within a UGB would be maintained by the

city rather than city limits. A complicating factor in La Pine is that the City does not yet have a public works department.

The TSP project list totals $306 million in improvements for the next 20 years with eighteen (18) projects identified as high priority, the thirty-two (32) as medium priority, and the forty-four (44) projects classified as low priority. These costs do not include any County components of ODOT's $250 million proposed project for US 97 at the north end of Bend. Much of that project exceeds the TSP's 20-year timeline. Both phases of the Wickiup Junction interchange project on US 97 are included in the estimates. The County anticipates when the La Pine TSP is completed the $104 million project will be removed from the County's list of identified improvements. The first phase, at $24 million, is a medium priority and the $80-million second phase is a low priority.

In terms of costs by jurisdiction, the Highway projects total $350.6 million while County road projects total $61.3 million and County bridge projects total $3.4 million; in terms of mode, bike and pedestrian stand-alone projects are $570,000 worth of sidewalks or trails.

High Priority Projects (0-5 years)	Total	$107,100,000
Medium Priority Projects (6-10 years)	Total	$75,900,000
Low Priority Projects (11-20 years)	Total	$123,229,125
Total 20-Year Combined Project Costs:		**$306,229,125**

The ability of the County to fund needed projects is in doubt. If the County only built the nearly $98 million State and County high priority projects over the next 20 years, the financial need would be $4.8 million annually. Granted, the County would be paying a percentage of the costs of projects on the State system, which total $65.4 million of the nearly $98 million. Assuming 10 percent County participation on State projects ranked as high priority, the County would have to pay $327,250 annually for 20 years toward State highway projects. (The County percentage is for discussion purposes only.)

Shrinking the project list to just those only on the County system and ranked high, the total is still $32.4 million over 20 years or $1.6 million annually. While more easily achievable from a financial sense, from a transportation system perspective it would be counter-productive to have a functioning County road network coupled to a failing State network. Simply put, the County needs a well-functioning State highway system for both economic and livability reasons.

The County would still need to pay nearly $2 million annually for 20 years over the life of the plan assuming only County high priority projects are built and that the County paid 10 percent for high priority State highway projects. Thus even using these conservative estimates, the County has a modernization need of $1.6 million annually, coupled with a maintenance need of nearly $3 million annually.

6.3 Possible Funding Sources

There are several potential funding sources for needed County transportation system improvements. These include the transportation SDC, regional gas taxes, the Transient Lodging Tax, exactions, local improvement districts, bonding, special assessments fees and vehicle fees. These are sources that have been used in the past by agencies in Oregon and could be used in combination. There may also need to be more public/private partnerships.

Examples of funding sources that generally cannot provide funds for roadways include: property tax, business income or license taxes, and general funds.

Although motor vehicle revenues fund many of the State highway, county and city projects within Deschutes County, major transportation projects may need to be brought to a public vote for approval. This would be necessary to supplement existing funding sources, which cannot keep up with growing needs. Specific projects would be defined in a ballot measure, such as the Major Streets Transportation Improvement Program (MSTIP) passed by voters in Washington County. Because of the need to gain public approval for transportation funding, it is important to develop a consensus in the community supporting needed transportation improvements. That is the value of the Transportation System Plan.

Based upon current sources of funding, the cost of the needs far exceeds the projected funding over 20 years. Some of the difference can be made up by land use development exactions, where unimproved frontage is built to the TSP standards as projects are implemented. To overcome the projected funding shortfalls in existing revenue sources, and build identified projects from the Transportation Project List, the County may wish to consider the following funding options:

State Highway Trust Fund

The state currently collects gas taxes, vehicle registration fees, fines and weight/mile taxes. These funds are pooled with a portion returned to individual cities and counties through an allocation formula. As of July 2011 the formula remains:

- The state keeps 60 percent.
- Cities receive 16 percent, which is apportioned to individual cities based on their population.
- Counties receive 24 percent, which is apportioned to individual counties based on the number of vehicles registered in that county.

The 2009 Jobs and Transportation Act raised about an additional $300 million annually The legislation allocated $3 million to the Travel Information Council for rest areas, $24 million annually to the State, and the balance distributed as 50 percent to the State, 30 percent to the counties, and 20 percent to the cities. This nickel was the first increase in the State gas tax since 1993.

Local Gas Tax

The State, cities and counties can provide their basic roadway funding through a tax placed on gasoline. The State gas tax is approved legislatively while local gas taxes are voter-approved. Vehicle registration fees can be enacted by ordinance. State Highway Trust funds are dedicated to roadway construction and maintenance, with one percent allocated to pedestrian and bicycle needs. This tax does not fall under the Measure 5 limits because it is a pay-as-you-go user tax. A local gas tax would require voter approval (ORS 203.055)

As part of the recent increase in the State's gas tax, the Legislature imposed a four-year moratorium on city and county gas tax ordinances and required voter approval of such taxes after January 1, 2014. A 1 cent per gallon gas tax would be expected to raise $800,000 per year, although the County's portion would depend upon revenue-sharing agreements with the four cities. The State currently taxes gas at 30 cents per gallon and the federal tax is 18.4 cents per gallon. As of this writing, gas is nearing $4.00 per gallon.

Of Oregon's 36 counties, only two have a local gas tax in place. Multnomah County (3 cents per gallon) and Washington County (1 cent per gallon) use a local gas tax for funding road projects. These counties contract with the State Fuel Tax Branch to collect and administer the tax. Gasoline distributors who deliver in those counties submit separate distribution reports along with their state report identifying how many gallons were delivered to each county. The state processes the county forms, calculates the tax revenue, subtracts the administration fee portion, and sends the county its revenue. Multnomah County retains 53% of its fuel tax revenue for road improvements in the unincorporated areas of the County, then distributes the rest to the cities on a per capita basis.

Local Vehicle Registration Fee

Deschutes County currently has 199,254 registered vehicles. A local biennial registration fee of $15 would yield $1.49 million per year. Under State law, 40 percent of the collected fee goes to the cities within the county, unless they agree to a different percentage. Multnomah County adopted a $38 biennial vehicle registration fee to help fund the Sellwood Bridge replacement. The State's base biennial registration fee is $86 for passenger cars and light trucks and $48 for motorcycles.

Street Utility/Road User Fee

Already used in Ashland and pioneered in Oregon in 1985 by La Grande, road user fees are a monthly or yearly assessment charged to residences and non-residential users of County roads. This fee is similar to sewer and water fees charged to users on a monthly basis. In Ashland, the fee varies depending on the type of land use but is $7.71 a month for a single-family home. In La Grande, they charge $2.50 per water meter per month. These fees are not for capacity improvements, but for supporting local road maintenance based upon land use type and trip generation. The exclusive use of the fees for maintenance allows a more uniform distribution of spending and frees up other revenue sources for capacity needs.

If a $1 per month fee per dwelling were used in Deschutes County, approximately $750,000 could be generated per year Countywide or $250,000 for the unincorporated areas only. Utility fees could be vulnerable to Measure 5 limitations, unless they include provisions for property owners to reduce or eliminate charges based on actual use.

Aggregate Fee (Natural Resources Transportation Fee)

The intent is essentially to have a local weight-mile tax for trucks that haul rock and gravel. A fee of 15 cents per ton would generate $300,000 per year based on the State's estimation of Deschutes County consuming 2,000,000 tons per year.

County Service District for Roads

A rural tax levy for the unincorporated areas of 53 cents per $1,000 valuation would generate $3 million annually based on Fiscal Year 2010-11 taxable assessed values. Voter approval would be required to form such a district. Washington County currently levies such a fee.

Property Tax (Local Option Tax)

A countywide tax rate of 18 cents per $1,000 valuation would generate $3 million annually while a rural-only rate of 53 cents per $1,000 valuation would generate $3 million based on Fiscal Year 2010-11 taxable assessed values. The tax must be approved by voters and can only be authorized for five (5) years, or, if for a capital project the expected useful life of the project up to a maximum of ten (10) years.

County Road Bonding Act

The annual revenue would be set by the governing body, but authority to issue the bond must be decided in an election. The funding and interest is added to the general levy of taxes for all taxable property within the County. Money raised by the bond must be used for construction and maintenance of permanent roads in the County.

Exactions

Development exactions and contributions often pay for portions of many roads in and through new developments. The road, or improvements to a road, are many times paid for or built by a developer to County standard, then deeded to the County as a development condition of approval. This practice has been modified by Oregon case law over the years, but will continue to be used throughout the state. Developers of sites adjacent to improvements identified as SDC projects can be credited the value of their frontage work, which is included in the SDC project-list cost estimate.

Rural System Development Charge (SDC)

System development charges are authorized by state law, and have been used in Oregon and throughout the United States. The County adopted an SDC in 2006 for the purpose of constructing four traffic signals in the then urban unincorporated community of La Pine. The SDC was assessed only for developments in South County, which was defined as from La Pine State Rec Road south. In 2008 the Board adopted the current countywide SDC.

The basic principles in development of SDCs are that:

1. There must be a reasonable connection between growth generated by development and the facilities constructed to serve that growth (generally determined by level of service or connectivity); and

2. There must be a general system-wide connection between the fees collected from the development and the benefits development receives. Charges are typically developed based on a measurement of the demand that new development places on the street system and the capital costs required to meet that demand. SDCs do not require a vote of the public.

The SDC amount is assessed at the time of development approval or building permit issuance and based on the anticipated number of trips generated by the proposed land use. The charge is a means of requiring new developments to pay an equitable portion of the capital costs of improvements needed to accommodate growth. Charges to recently developed properties can be used to recover past and/or

future growth-related improvements. However, they may not be used to recover costs for improvements to serve existing users and residents. By law, the funds must be used for capital improvements only and are not eligible to be used for operations or routine road maintenance.

Like all road SDCs, a countywide road SDC is not adequate for complete project funding but forms an important financing component for new capacity-enhancing projects. Following adoption of the TSP and its project list, the County will need to recalculate the SDC based on new project costs.

Grants

From time to time, grant funding becomes available. Grants are most often funding matches, whereby the local jurisdiction must contribute a percentage of the funds to complete the project. Often, the local contribution is an "in-kind" pledge of resources for planning, engineering and design services or materials from the local jurisdiction. However, some grants are 100% awards. Most grants are only to be used for capital improvements or planning studies, not maintenance. The County should be prepared with eligible transportation projects that can be plugged into a grant category on short notice. Often these projects will not have alternate funding sources, and therefore must rely on grants, to be completed. Recent direction by the Oregon Transportation Commission (OTC) is to offer significant amounts of grant monies for non-highway projects such as the Tumalo Trail.

Special Road Districts

Special road districts provide a means for funding specific improvements that benefit a specific group of property owners. These districts require owner approval and a specific project definition. The residents forming the district agree to pay property taxes to support the special district. Road District Commissioners are appointed by the Deschutes County Board of Commissioners to operate the district.

Local Improvement District (LID)

Local residents can petition the County Board of Commissioners to form an LID to get their road improved. Previously, once a public dirt or gravel road was improved under the LID process, the road was accepted or "established" as a County road to be maintained by the County. After the federal timber program began to diminish in 2006, the Board passed a moratorium on accepting any new roads into the County system save for a few already in process. In 2009 the Board amended the moratorium to have the discretion to accept new arterials or collectors into the County system. Property owners agree to pay for road improvements made under an LID. The tradeoff is that as LIDs form, the County becomes responsible for more miles of road maintenance, which spreads limited funds even thinner over the long term.

APPENDIX A – LINKS TO ODOT PLANS AND GUIDES

Oregon Bicycle and Pedestrian Design Guide

http://cms.oregon.egov.com/ODOT/HWY/BIKEPED/pages/planproc.aspx

Oregon Highway Plan

http://cms.oregon.egov.com/ODOT/TD/TP/pages/ohp.aspx

Oregon Transportation Plan

http://cms.oregon.egov.com/ODOT/TD/TP/pages/otp.aspx

STAFF REPORT

TO: Deschutes County TSP Update Technical Advisory Committee

FROM: Peter Russell, Senior Transportation Planner

DATE: April 21, 2009

SUBJECT: Technical Memo #1, TSP Assessment

PURPOSE

As part of the update of the Deschutes County Transportation System Plan (TSP), this memo reviews the significant changes in Deschutes County since the plan's 1999 adoption. Topics covered include population, destination resorts, changes to TSP's in urban areas, different performance standards for state highways, revisions to the state's bicycle and pedestrian plan, rise of destination resorts, and differing financial assumptions.

Technical Memo #1 analyzes these changes in a broad approach. The memo is organized by chapter and captures general themes with specific supporting examples. The assessment follows the same order the materials were presented in the previous TSP.

The introductory chapter requires several revisions that range from general policy to specific factual data.

CHAPTER 1, INTRODUCTION

1.1 Setting

The population figures for Deschutes County and its cities of Bend, Redmond, and Sisters need revision and add the data for the new City of La Pine. Insert a reference of the amount of commuters who arrive in the county from Prineville. Similarly, discuss rise of destination resorts as only Black Butte, Eagle Crest, and Sunriver were in existence then but resorts now include in 1999

1.2 Transportation System Plan Requirements

The summary of the Transportation Planning Rule (TPR) remains valid. The goals and objectives of the TPR have not changed, but the administrative rule language has been slightly modified and the update will need to reflect those changes. The plan will reference that Bend, Redmond, and Sisters have all updated their TSP's as well.

Another TPR change relates to population growth in that Bend has become a Metropolitan Planning Organization (MPO). Changes in the Deschutes County TSP Update will have to be then amended into the BMPO Regional Transportation Plan (RTP).

1.3 Developing a Transportation System Plan

The review process for the TSP update differs slightly from the 1999 plan. There is no longer a County Transportation Advisory Committee (CTAC); the update includes a Technical Advisory Committee

(TAC), a Steering Committee (SC), a Stakeholders Group (SG), and work with the Deschutes County Bicycle and Pedestrian Advisory Committee (BPAC), county staff, and the general public.

In terms of forecasting future traffic volumes for the next 20 years, I'll add language about ODOT's efforts to develop a rural travel demand model for Deschutes County and how that incorporates the Bend and Redmond models. The horizon year now shifts from 2016 to 2030.

For the Public Transportation Needs section, add verbiage about Bend's fixed-route system, Cascades East Transit, and park and more on Commute Options, especially the demand for increasing capacity at park and ride lots and adding new ones.

The plan drew heavily upon ODOT's 1991 "Bicycle and Pedestrian Plan" which has been revised. Also incorporate work with BPAC, Senator Wyden's Central Oregon Recreation Assets Committee's work on bicycle routes, and the Road Department's pavement management system policy and practices. The latter have been revamped to be more bike friendly.

The Financing Plan has changed dramatically. The county has seen a loss of timber funds, the Board of County Commissioners (BOCC) has adopted a moratorium on no new County roads as a result, and the Board has adopted a countywide system development charge (SDC) as well as increasing tipping fees at the Knott Landfill to close the funding gap.

CHAPTER 2, INVENTORY AND BACKGROUND

2.1 Existing Transportation Goals and Objectives

The County is simultaneously updating the 1979 comprehensive plan so the section on the Comp Plan will need to be revised to reflect how these parallel processes are coordinating.

The paragraph on the Major Roads Capital Improvement Program (MRCIP) dates from 1996. The section and associated tables will be updated to remove completed projects, cites the most current CIP, and reference post-1998 Board policies which relate to no longer accepting new roads into the county jurisdiction due to loss of federal timber revenues (BOCC Resolution 2006-049).

Deschutes County Bicycle and Pedestrian Advisory Committee (BPAC) is working with County staff for a proposed system of designated bicycle routes. Additionally, the 1998 TSP's bicycle elements were almost exclusively based on ODOT's 1992 Bicycle and Pedestrian Plan, which has since been updated.

Additionally, the cities of Bend, Redmond, and Sisters have all updated their TSP's and those changes will need to be captured in the County TSP update. Redmond Airport has updated its master plan, but the Bend Airport plan remains the status quo. This could change as the City desires to develop more aviation-related or supportive land in proximity to the airport and the Board also has suggested the City update the Bend Airport master plan.

The 1992 Oregon Transportation Plan (OTP) was superseded by the 2006 version. The OTP provides guidance to ODOT on how to provide a multimodal transportation system, including financial assumptions. The agency states the OTP "provides a framework to further these policy objectives with emphasis on maintaining the assets in place, optimizing the existing system performance through technology and better system integration, creating sustainable funding and investing in strategic capacity enhancements." A plain English translation is reportedly in the works.

One of the most dramatic changes is the 1999 Oregon Highway Plan (OHP), which had wholesale revisions from the 1991 OHP. The 1999 OHP altered ODOT's performance standards, modified the functional classification scheme, added several overlay classifications, and incorporated changes to the OAR's dealing with access management.

The TSP update will need to replace LOS on the state system with Volume/Capacity (v/c) Ratios. The level of importance (LOI) classification system has been refined to include classification for specific segments by mile point instead of a single designation for a route's entire length. The OHP has added segment overlays such as Expressway, Freight Route, and Special Transportation Area (STA).

The TSP describes ODOT's previous access management policy under OAR Chapter 734, Division 50 which was arranged by Category 1 through 4 for highways. Since then ODOT has overhauled its access management policies and implements them through OAR Chapter 734, Division 51 and the 1999 OHP. Access management now depends on functional classification, posted speed, and overlay designations.

It's unclear the status within ODOT of the Access Oregon Highway (AOH) system, corridor plans and strategies, the Governor's (Kitzhaber) Transportation Initiative and how or whether the TSP Update will need to address any of these items.

Similarly, ODOT will need to provide guidance on an Oregon Transportation Commission (OTC) set a goal that by 2010 that 96% of all Oregon highways be able to accommodate trucks of less than 80,000 pounds. The County would need to know if that goal has been met and can be dropped from the TSP or altered or replaced. The Oregon Freight Advisory Committee has dealt with many issues since the TSP's 1998 adoption and the agency can share with the County any policy implications or goals. The TSP update should identify the barriers that length restrictions on O'Neil Highway, a state facility, and weight restrictions on Smith Rock Way, a County facility, present to the movement of freight originating in western Crook County and bound markets in Deschutes County.

I would recommend keeping the summary of ODOT's Statewide Transportation Improvement Program (STIP) in the TSP, but deleting the table with current STIP projects. The TSP is a 20-year document so the projects in the current three-year STIP should be identified in an appendix.

The 2000 Oregon Aviation System Plan (OASP) referenced in the 1998 TSP was redone in 2007 and renamed the Oregon Aviation Plan (OAP). Deschutes County incorporated many of the goals of the OASP in its development code in Title 18 to ensure airport-land use compatibility, imaginary surfaces, and height restrictions. The 2007 OAP at Table 1.1 would indicate the county is consistent with the aviation plan.

The 1995 Oregon Bicycle and Pedestrian Plan is currently under revision. The County will update the bike and pedestrian topics with the newer information that pertains to accommodating bicyclists and pedestrians in rural areas and urban unincorporated communities.

The conclusions of the Central Oregon Area Commission on Transportation (COACT) regarding at-grade rail crossings in Deschutes County needs to be added to the TSP update.

Finally, the current 2.1 concludes with a brief description and summary of the 1996 Oregon Travel Behavior Summary. I would defer to ODOT on whether we want to include similar verbiage for the development of the traffic model for the Deschutes County TSP.

2.2 Existing Transportation System and Current Needs

The mileage figures for existing county-maintained roads has decreased from 943 total miles to 830 total miles. The amount of paved miles has decreased from 750 in 1998 to 700 in 2009 while unpaved miles have dropped from 193 to 130 miles. The change is due to a combination of county turning over jurisdiction to cities as their UGB's expand and from paving rural roads.

I'll summarize the findings of the Technical Memo #2, "Existing Conditions," and add it to this section.

In the subsection under types of roads, include language about BOCC Resolution 2006-049 in which the Board said the county would longer accept new roads into county jurisdiction due to the loss of timber revenues.

The 1998 TSP has a mix of terms such as Principal Arterial, Primary Arterial, Urban and Rural Major Arterial, Urban and Rural Minor Arterial, Urban and Rural Collector, etc. The update will standardize the classification terms.

Powell Butte Highway is no longer a state highway.

Several road segments will be upgraded from collector to arterial as part of the Bend and Redmond UGB expansions. In the Bend area the reclassifications from collector to arterial include Deschutes Market, Hamby, Ward, O.B. Riley, an extension of Cooley west across U.S. 20, and a future arterial in northwest Bend. Redmond saw Helmholtz and Northwest Way upgraded from collector to arterial.

Under traffic control devices there is now a signal at Burgess/Day and the county has conceptually agreed to rural roundabouts, including the intersections of Powell Butte Highway/Butler Market and Powell Butte Highway/Nelson. The flashing beacon at Deschutes Market/97 has been replaced with a grade-separated interchange. Similarly, the beacon at South Century/97 was replaced with a grade-separated interchange. The Burgess/Huntington traffic signal being installed this spring will replace the beacon at that location. The County has added an all-way flashing red beacon to Neff/Hamby intersection, which is at the eastern edge of Bend, and flashing red lights to the stop signs at Coyner/Northwest Way, which is between Terrebonne and Redmond.

Traffic volumes will be updated to reflect 2008 data on both the State and County systems. Add verbiage summarizing the changes or trends since 1998. The bulk of the County system does not carry significant daily volumes, i.e., greater than 3,000 ADT. Update information in Table 2.2.T4 (Top County Rural Road Volumes and Estimated LOS) of what percentage of the 404 county-maintained arterials and collectors has more than 1,500 ADT.

Augment the discussion of LOS, which the County still uses, with volume/capacity, which the state now uses. Take the v/c explanation from the OHP, and then try to modify Table 2.2.T3 (Generalized County Road Highway ADT/LOS) to reflect these changes. Similarly, Table 2.2.TF (ODOT 1996 Highway Volumes and Estimated LOS) needs to be updated for both volumes and analysis methodology.

Update crash history information for most recent year available and identify locations that for highways either exceed the statewide average for similar facilities or are Safety Priority Indexing Sites (SPIS). For county roads, identify those that have crash rate of more than 1.0 per million entering vehicles (MEV). Update Figure 2.2.F14 (High Accident Locations) and tables 2.2.T6 (Top County Road Accident Locations 1991-1996) and 2.2T7 (Top Highway Accident Locations, 1991-1996). This work was originally performed under a Safe Communities grant from the federal government.

Calculate percentage of unpaved County collectors.

Update Table 2.2.T10 (County Bridges) in terms of weight limits and costs to upgrade.

Replace Table 2.2.T9 (Current County Road Standards) with Table A (Rural County Roads) from Deschutes County Code (DCC) 17.48.160.

Bike facilities have been incorporated in Table B and DCC 17.36.140 and 17.48.140 to accommodate bikes on County and private roads; bike parking requirements are found in 18.116.031 and 035. Replace Table 2.2.T12 (Current County Bikeway Design Standards) with Table B.

Additionally, county staff is working with the Deschutes County Bicycle and Pedestrian Advisory Committee (BPAC) on a bike system with prioritized improvements. Finally, County staff and BPAC are coordinating with Senator Ron Wyden's (D-OR) on his Central Oregon Recreation Assets proposal as it relates to bicycling opportunities.

Add language referencing bike and sidewalk requirements in Terrebonne and Tumalo that was completed after 1998. Add BPAC language about alternative routes to U.S. 20 between Bend and Sisters.

Propose to eliminate section detailing bike facilities in resort communities, except for retaining policy language that resort bike facilities "…shall meet County standards construction standards and shall not impede movement within the countywide system."

In the pedestrian/sidewalk section, again refer to Table B and add language about the non-motorized transportation plans for Terrebonne and Tumalo that were adopted post-1998.

Public transportation has substantially changed since the 1998 plan was adopted. Greyhound no longer fetches passengers, but several shuttles still provide service from Central Oregon to the Willamette Valley. COIC is running Cascades East Transit, which provides service in the tri-county area to Bend. Bend now has fixed route service with Bend Area Transit (BAT).

Localized demand response has expanded to include Green Energy Transport and High Desert Wheelchair Transport in addition to dial-a-ride services in the tri-county area through either the City of Bend or COIC.

The number of park and ride lots has expanded to include Bend, La Pine, Prineville, Sunriver, and Terrebonne. There are still several informal locations along U.S. 97 in South County.

Railroad ownership has changed with Union Pacific purchasing Southern Pacific. The Central Oregon Area Commission on Transportation (COACT) has requested the counties and cities of Deschutes, Crook, and Jefferson along with ODOT conduct a long-term strategy to address at-grade railroad crossings in Central Oregon. The study found it was mot feasible to relocate the BNSF line east of Bend and Redmond. The study is now prioritizing the list of at-grade crossing for upgrading to grade-separated crossings or closures; the work will also include cost estimates for these upgrades. The Baker Road crossing of the BNSF tracks just west of the on/off ramps to U.S. 97 was ranked first among rural crossings in Deschutes County by Deschutes County planning and Road Department staff.

U.S. 97 and U.S. 20 are designated Freight Routes whereas the previous TSP had not state-designated truck routes.

For airports, since 1998 the County has developed code to protect the operations of existing airports and ensure land use compatibility via DCC 18.76 and 18.80. The former applies only to development at the Bend Municipal Airport. The airport safety (AS) zoning applies to the to the Bend, Redmond, Sisters, and Sunriver airports as well as the Cline Falls and Juniper airparks.

Update Table 2.2.T13, Roberts Field Emplanements, 1998-2008. Redmond has expanded service to Denver, Las Vegas, and Los Angeles.

Section 2.3 Existing Land Use, Population, and Employment

Maintain the focus on MUA-10 and RR-10 zones as this is where the bulk of the developable land lies in the county and a secondary emphasis on rural industrial, urban unincorporated, and lands mapped for destination resorts in close proximity to U.S. 97.

Urban Unincorporated Community delete La Pine. Existing destination resorts add Caldera Springs, Pronghorn, Tetherow, and Thornburgh (approved, appealed, unbuilt), and reference to the destination resorts in western Crook County that add traffic to Powell Butte Highway and OR 126.

Update Table 2.3.T1 (Unincorporated Community Summary) that displays total existing lots, developed lots, number of lots with development constraints, and provides potential new development by both lots and acreage.

Potential Impact Development Analysis (PDIA) work was not used by ODOT and should be omitted.

Update future traffic volumes in "Development Constraints" subsection with TPAU's modeling information as it becomes available.

Table 2.3.T4 (Deschutes County Population) needs to be revised with most recent data as well as updating 1996 employment data.

The 1990 Census data on "journey to work" mode needs to be revised and displayed in Table 2.3.T6. Update Table 2.3.T7 (Travel Time to Work).

Propose to either nix Oregon Travel Behavior Summary or update information with the sampling and modeling techniques used by TPAU for development of the Deschutes County travel demand model.

CHAPTER 3, TRANSPORTATION FORECAST

3.1 General Background

Major difference is the development of a traffic forecasting model for the areas of the county outside of land covered by the Bend MPO and Redmond traffic models. Previously, the TSP used a combination of straight-line traffic projections, land absorption rates, developable lots. Lastly, the TSP utilized an early 1990's attempt by ODOT to forecast how land use supply could affect generally affect highway segments or intersections. This was called Potential Development Impact Analysis (PDIA), but the agency did not continue to pursue this approach. References to PDIA will be dropped or dramatically shortened and replaced with background information on the new ODOT traffic model for Deschutes County.

3.2 Population and Employment Forecast

Update Tables 3.2.T1-T8 dealing with population in cities and unincorporated areas as well as employees in those same categories. Redo text to reflect building trends from 1998-2008 for homes built annually in rural county. Confirm assumptions about vacancies for houses on rural or unincorporated land due to seasonal, second, or vacation homes remains valid.

3.3 Traffic Forecast

Previous forecast was based on 8 trips per housing unit, a trip generation rate that was taken from ODOT's travel behavior work in the county in the 1990s. Replace that information with background detail from ODOT's development of the Deschutes County traffic model.

The bulk of 3.3 will be taken from Tech Memo #3, Future Conditions, which will be done later in the TSP update process. Include explanation of volume/capacity (V/C) ratio which ODOT now uses, replacing the Level of Service (LOS). The County continues to use LOS.

Provide discussion of the differences of analyzing segments of roads vs. specific intersections. Identify segments and/or intersections that will not meet the county and ODOT performance standards in 2030 or will be approaching failure.

Update County and State volume traffic volume tables, 3.3.T1 and 2.

CHAPTER 4, TRANSPORTATION NEEDS ANALYSIS

4.1 Transportation Facility Deficiencies

Insert conclusions from Tech Memo #3 and Tech Memo #4, Transportation Mitigations Alternatives Analysis.

4.2 Public Involvement and Interagency Coordination

Document public meetings, Deschutes County Bicycle and Pedestrian Advisory Committee (BPAC), La Pine Transportation Advisory Group (LPTAG), Technical Advisory Committee (TAC) and Steering Committee (SC) meetings, stakeholders group, and work sessions with Deschutes County Planning Commission and the Board of County Commissioners.

Provide specifics of the above with revised Table 4.2T1 (Public Outreach). These would include public meetings; BPAC meetings; TAC, SC, and stakeholder meetings; and Planning Commission and BOCC work sessions and meetings.

Of the four intersections identified with traffic congestion, two have been improved with interchanges (Deschutes Market/U.S. 97 and South Century Drive/U.S. 97) another has had a traffic signal installed (Venture Lane/South Century Drive by Sunriver Business Park) while Cook-O.B. Riley/U.S. 20 in Tumalo continues to have congestion problems. Additionally, Baker Road between the U.S. 97 ramps and Brookswood Boulevard in southern Bend has congestion issues as does Lower Bridge Way/97 at the north end of Terrebonne.

The 1998 plan list two dozen intersections or road segments with safety issues. Of those nine have already been addressed by constructed or programmed improvements.

- Deschutes Market/U.S. 97 – Interchange built, second phase being done in 2009
- U.S. 20/OR 242 in Sisters – Median and turn pockets constructed
- Burgess/U.S. 97 – Realignment completed
- Rosland/Wickiup Junction frontage road – Constructed

- South Century/U.S. 97 southbound decel lane – Improved
- Deer migration across U.S. 97 south of Bend – Divided highway with wildlife undercrossings programmed for construction 2009-12(?)
- Helmholtz/OR 126 – Channelizations improvements
- Burgess/Huntington – Flashing light added
- Burgess/Day Road – Westbound right turn lane added; eastbound left turn bay still needed
- Secondary access from Deschutes River Woods to U.S. 97 – Emergency gated access built

During the public involvement process, several other intersections not previously mentioned in the document were identified as sites of concern. Also crash data from the Road Department identified intersections with crash rates of higher than 1.0 per million entering vehicles (MEV), which is an accepted indicator of a problematic location.

The public identified the following areas of concern:

- Deschutes Market Road/U.S. 97 ramps – The southbound on and off ramps are too short as is the northbound off ramp; there is no room for drivers to decelerate off of the main travel lane
- Gift-Pleasant Ridge/U.S. 97 intersection – Rising volumes on the highway make this a difficult intersection to turn from U.S. 97 onto the highway and difficult to cross the highway.
- Erickson-Torkleson/U.S. 20 – Located east of Bend, this intersection is just west of the Powell Butte Highway/U.S. 20 intersection and drivers often mistake the former for the latter, leading to sudden maneuvers; signing for Powell Butte and Bend Airport adds to the confusion
- Lower Bridge Way/31st – Poor visibility makes it hazardous to pull out onto Lower Bridge
- Lower Bridge/43rd – Poor visibility makes it difficult to pull out onto Lower Bridge
- Lower Bridge Way/97 – Skewed geometry and higher volumes on both Lower Bridge and the highway makes this a difficult intersection to use. ODOT does have a project programmed to improve the geometry.

For long term needs, add language on ODOT's bypass policy to the discussion of new routes around the east side of Bend, La Pine-Wickiup Junction, Redmond, and Sisters. OHP Policy 1H: Bypasses, did not exist in 1998, and discusses measures that must be be taken before the state will even consider a bypass. Policy 1H has language about protecting existing bypasses, but Deschutes County has none.

Transit needs portion will be revised to reflect Cascades East Transit (CET) is now providing service to Bend from the tri-county area with connections to Bend's fixed-route service. There is still no public transit to the Redmond Airport.

The 1998 plan had a long section on Regional Problem Solving, which dealt with secondary access to rural subdivisions in South County. The update will include future road alignments identified by the La Pine Transportation Advisory Group to provide emergency egress to those areas.

CHAPTER 5, TRANSPORTATION SYSTEM PLAN

Change the reference to reduce reliance of "single-occupant vehicle" to current TPR language about strive to prevent becoming overly reliant on any single mode of transportation.

Add language about Bend now is a Metropolitan Planning Organization (MPO) and include map showing which county lands are now in the BMPO. Revise to include advances in transit since the 1998 plan was finished.

Document the prioritization process for ranking projects into high (0-5 years), medium (6-10 years) and low (10-20 years) categories.

5.1 Coordination and Implementation of the Transportation System Plan

Review Goals and Policies to at conclusion of TSP Update and change as needed.

In Goal 1, Policy 1d, correct to read ODOT's Statewide Transportation Improvement Program (STIP).

5.2 Arterial and Collector Road Plan

Again, some of the language we won't if it is still correct until TPAU's traffic forecasting is completed. The 1998 concluded the County transportation system would have adequate capacity until 2016 and that most improvements would be tied to safety, not operational needs with a few exceptions on the rural-urban fringe.

Add language to policy 8 referencing BOCC Resolution 2006-049 where the county will no longer accept any new roads to maintain due to loss of federal revenue from timber.

State highway section replace references to 1991 OHP and its policies, classification schemes, and performance standards with the references to the 1999 OHP on these same topics. Delete all references to Category 1-4 highways as the agency has replaced that hierarchy. Delete all references to Access Oregon Highway (AOH) for similar reasons.

1998 TSP has strict language saying traffic signals outside of UGB's with the exception of Terrebonne or La Pine. Delete La Pine reference. Pending discussion with ODOT and further work in TSP update, the language may need to be further refined to either add Tumalo or delete Terrebonne or stay status quo, except for La Pine.

Expand "four-phase approach" of improving two-lane rural highways to ultimately four-lane facilities with divided lanes, medians, grade-separated interchanges, and frontage roads to include U.S. 20 and OR 126.

South Century interchange has been built, removed it from bulleted list.

Identify Quarry Road as the reference point for a future grade-separated interchange between Yew Avenue in southern Redmond and Deschutes Market Road.

The 1998 TSP alludes to the then-under way "Salem-Bend OR 22/U.S. 20 Corridor Strategy." As ODOT never adopted the strategy and no longer uses this type of facility management planning tool, how should this document's recommendations be addressed?

In the U.S. 20 section, add references to upcoming refinement plans by ODOT for the segment bounded by Deschutes River and Gerking Market Road; compile a prioritized list of geometrically flawed intersections and whether these will be improved, closed, or upgraded to higher level of traffic control. Add language regarding the need for a parallel, off-highway bicycling route between Sisters and Bend.

In the OR 126 section add relocation of highway to north of Runway Protection Zone for Redmond Airport to bulleted list; add reference to Eastside Framework Plan and future plans for highway.

Revise LOS table to reflect ADT intervals for county roads. Defer edits to County and highway segments approaching capacity until Tech Memo #3 is completed.

Goal 10, Policy 31 add La Pine to listed cities with which the county coordinates for transportation solutions.

For truck section, update to identify Freight Route designations on state highway. Doubt 1998 plan language of restricting trucks to arterials is legal. Soften to say encourage to use arterials.

In the facility/safety improvements, all the text is from a Safe Communities grant from the mid-90's. Replace with data collected from Road Department for county roads for crash rates per million entering vehicles for intersections, data for fatal and serious injury non-intersection crashes, and ODOT's SPIS for state highways.

Functional classification needs to be redone to distinguish between county classification and the federal scheme. County scheme has Primary Arterial (U.S. 97, U.S. 20, OR 126, etc.), Rural Arterial (Deschutes Market Road, Old Bend-Redmond Highway, River Summit Drive, etc.), Rural Collector (Indian Ford Road, Lower Bridge Way, La Pine State Rec Road, etc.), and Forest Highway (Cascade Lakes Highway, China Hat Road, Paulina Lakes Road, etc). The county does have a Local Road classification, but the TSP focuses on collectors and above. The exception are Local Roads needed for emergency secondary access for isolated rural subdivisions.

Changes to Functional Classifications Since 1998:
County staff is in the process of amending the TSP map to add 19th Street, a future arterial between Bend and Redmond.

Bend area: Collector>Arterial: Deschutes Market, Hamby, Ward, Cooley, O.B. Riley roads or portions thereof and future arterial in NW Bend between current UGB and Johnson Road.

Redmond Area: Collector>Arterial: Future extension of Helmholtz to a future interchange at Quarry/97.

Other issues that remain unresolved is a secondary access to Crooked River Ranch to Lower Bridge Way.

Update Road and Streets Standards to reflect Title 17 and 18.

5.3 Public Transportation Plan
Add text about Bend fixed-route service and development of Cascades East Transit from outlying areas.

A 1997 survey found County residents wanted a fixed-route service. In June 2007 another survey was done for the tri-county Mobility Consortium. That survey also found a strong preference for fixed-route transit (58% very likely or somewhat likely to use such a service for their commute) or shuttle service (53% very likely or somewhat likely to use to commute).

Update text to indicate ride share lots in Bend, Redmond, Sisters, La Pine, and Prineville.

Update text to indicate presence of Hawthorne Center on BAT system. Add text indicating COIC is coordinating local demand-response service outside of Bend.

5.4 Bikeway and Pedestrian Plan
The first few pages of the current plan are specific to Deschutes County, then the remainder is essentially ODOT's 1992 Bicycle and Pedestrian Plan. I'd proposed maintaining the Deschutes County

specific materials, amend those materials to include the bicycle and pedestrian positions provided by BPAC regarding designated bike routes and future pedestrian trails, and dramatically condense the rest.

I'd keep the language about bikeways and how those those are different from bike lanes, that the bulk of pedestrian issues seem to be crossing county roads, and the ped needs within communities such as Terrebonne and Tumalo, and work to designate a county bike system on selected county arterials.

The BPAC suggestions call for 1) policy language toward the goal of paving USFS Road #41 between Bend and Sunriver; 2) paving Ponderosa, Savage, and Winchester between Spring River subdivision and La Pine; 3) maintain Huntington, South Century, and Riverview to the level seen on Old Bend-Redmond Hwy; 4) explore a paved connection between Sisters and Bend other than U.S. 20; 5) widen roads in the Tumalo Road Reservoir area (Johnson Market, Couch, PInehurst, Tyler, and Tweed) to aid cyclists; 6) pursue Oregon Scenic Bikeway designation for selected route; and 7) Redmond-Smith Rock pathway using North Canal Irrigation District ditch rider roads in interim then pave Antler and 33rd for a paved route to Smith Rock State Park.

The remaining non-motorized issue is the desire to utilize the Trans-Canada Pipeline right of way to the east of Bend as a corridor to access North County and Smith Rock State Park.

5.5 Airport Plan

The Redmond Airport has updated its master plan and thus will need to change the Redmond section in the TSP. Bend and Sisters have not updated their plans, but it has become a rising issue for Bend. Finally, the question of a public airport in the La Pine/Wickiup Junction area has taken off again.

The county updated its development code since 1998 to include an Airport Safety Combing Zone (AS) zone at DCC 18.80. This code protects Bend, Redmond, Sisters, and Sunriver airports and Cline Falls and Juniper airparks from land use encroachments or incompatible uses. DCC 18.80 was created in response to changes in OAR's related to aviation after the 1998 plan was completed.

The relationship between the Powell Butte Highway and expansion at the Bend Municipal Airport is an topic that will be addressed in the update to the TSP and the Bend Airport master plan. Similarly, the future of OR 126 and runway expansion to the north is a critical issue for the Redmond Airport.

5.6 Rail Plan

Incorporate the conclusions of the priority list for improving, closing, or relocating at-grade crossings as suggested by Central Oregon Rail Plan being done under the auspices of the COACT. Deschutes County staff and elected officials are participating in the study at the technical and policy level. This plan also deals with the potential for an intermodal reloading facility in the tri-county area, but focusing in particular on O'Neil Junction. A complementary study for COACT is an Economic Opportunity Analysis (EOA) for developing rail-dependent industrial lands in Central Oregon. Those conclusions will also be added to this section to the TSP Update as again county staff and elected officials have participated at both the technical and policy levels.

5.7 Water Plan

No change as there continues to be a drought of waterborne transportation in rural Deschutes County.

5.8 Pipeline Plan

No change other than the above reference as the potential use of the Trans-Canada natural gas pipeline for a non-motorized corridor to North County or Smith Rock State Park.

5.9 Transportation System Management (TSM) and Transportation Demand Management (TDM)

Everything remains relevant. Add language discussing the addition of park and ride lots since 1998 and the opportunity for even more. Discuss rise of rural shuttle service and how that can be tied to Bend's fixed-route service. Add language about encouraging economic development in South County to reduce employment-based commuting trips from La Pine to Bend. See if the proposed changes to the destination resort legislation that requires TDM measures and worker housing and include or exclude, accordingly.

5.10 Deschutes County Transportation Project List

Update based on final analysis of TSP Update by prioritization filters. Remove already completed projects that were once listed as future long-term projects in Table 5.11.T1 (Transportation Project List). Short-term is defined as one to five years, midterm is six to 10 years, and long-term is 11-20 years. These correspond to high, medium, and low priorities. Update project costs.

5.11 Short-term Improvement Projects

Update based on final analysis of TSP Update by prioritization filters. Remove already completed projects that were once listed as future short-term projects in Table 5.11.T1 (Transportation Project List). Short-term is defined as within one to five years and a high priority. Update project costs.

CHAPTER 6. TRANSPORTATION FINANCE PLAN

The majority of the finance chapter remains relevant in terms of state and federal funding such as gas taxes, vehicle registration fees, weight-mile fees, and grants as funding sources. The costs of projects identified in the TSP as well as costs to operate and maintain the road system will need to be updated.

The COACT board has discussed a regional gas tax given the state gas tax has not been increased since 1993. The major financial changes are the loss of federal timber revenues and the county's subsequent adoption of a South County SDC which was then supplanted by a countywide SDC.

Deschutes County was hard hit by the loss of federal funds tied to timber and the replacement federal funding when federal environmental protection led to the steep decline in logging. The county's Road Department received approximately $3.0 million annually under the Secure Rural School and Community Self-Determination Act of 2000. The program provided bridge funding at a declining rate to soften the loss of timber revenues, but is due to end.

As a result, the BOCC passed Resolution 2006-049 which stated the County would no longer accept new roads into the system of County-maintained roads. The moratorium lasts until replacement funding, in the BOCC's opinion, has been restored to adequate levels as timber revenues and their replacement constituted approximately a third of the Road Department's budget.

The county passed a limited SDC in March 2006 for four future signals in South County (Burgess/Huntington; 1st/Huntington; 1st/97; and Finley Butte/97) in July 2006. The SDC, Resolution 2006-010, only applied to lands from La Pine State Rec Road south. The 1st/Huntingon signal was completed in 2006 and Burgess/Huntington will be done in 2008. With the incorporation of La Pine in November 2006, the county no longer collected SDC's from lands lying within Oregon's newest city.

The county in July 2008 adopted a countywide SDC with Resolution 2008-059. The SDC applies to all lands outside of the Bend, Redmond, Sisters, and La Pine UGB's. Fees are collected no later than the

issuance of certificate of occupancy. The BOCC set a phased approach, beginning at 85% of the full SDC and increasing it by 5% every July 1 until the full amount is collected beginning in 2011.

STATE OF OREGON **INTEROFFICE MEMO**

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File Code:

Date: July 24, 2009

TO: Peter Russell
Community Development Department
Planning Division

FROM: Thanh Nguyen, PE, Senior Transportation System Analyst
Joseph L. Meek III, PE, Transportation Analyst
Transportation Planning Analysis Unit

SUBJECT: Deschutes County Transportation System Plan Update (TSP)
Technical Memo # 2 - Existing Traffic Conditions

The purpose of this technical memorandum is to describe and analyze the current (2008) traffic conditions in Deschutes County, including safety conditions and capacity deficiencies. The roadway system in Deschutes County is dominated by six state highways providing connections between Bend, Redmond, Sisters and La Pine. The jurisdiction of roadways studied includes Oregon Department of Transportation (ODOT) and Deschutes County. No city entities were included.

The functional classification of roadways provides guidelines for safe and efficient movement of people and goods between cities. Roads are categorized based upon the level of access and/or mobility provided. Functional classification of a roadway system involves determining what function each roadway should be performing with regard to travel between and through cities. The intent of a functional classification system is the creation of a roadway hierarchy that collects and distributes traffic from local roadways and collectors to arterials in a safe and efficient manner. Such classification aids in determining appropriate roadway widths, speed limits, intersection control, design features, accessibility and maintenance priorities. Functional classification helps to ensure that non-transportation factors, such as land use and development, are taken into account in planning and designing of the roadway system.

A balanced system is desired, yet not always attainable. The criteria of the functional classification system are guidelines to be applied when planning for the construction of a classified route. Roadways with similar design characteristics may have different functional classifications. Some roadways, for a short segment, may carry higher volumes than a higher classification roadway. The two major considerations in the classification of roadway networks are access and mobility. Mobility is of primary importance on arterials, thus limitation of access is a necessity. The primary function of a local roadway, however, is the provision of access,

which limits mobility. The extent and degree of access control is a very important factor in the function of a roadway. The classifications are dependent upon one another in order to provide a complete and functional system.

Figure 1 illustrates roadway jurisdiction and functional classification of Deschutes County. For the existing traffic condition analysis, rural principal arterials (state highways), rural minor arterials, rural major collectors and some urban collectors requested by Deschutes County have been studied. The requested urban collectors were Baker Road (from the US97 northbound ramps west to Brookswood Boulevard), and Burgess Road (from US97 west to Day Road). Figures 2 and 3 show state highways designated as National Highway System (NHS) highways and expressways, respectively.

The Deschutes County road network consists of two-lane roadways with turn lanes at some critical locations. The majority of traffic controls are stop signs with a mix of four-way stops, three-way stops and two-way stops. There is only one signal in the county at South Century Drive and Venture Lane intersection in the Sunriver resort community. All arterials and collectors in the county are paved except for the following roads:

- Buckhorn Road is a graveled surface from OR126 to NW Lower Bridge Way.
- Huntington Road: A portion of Huntington Road is gravel, from Riverview Drive (S) to Riverview Drive (N), (approximately 2.3 miles). Currently, all traffic uses Riverview Drive. The County is planning to realign Huntington Road at these two intersections and pave Huntington Road so it is the main road and Riverview Drive will be a "T-type" intersection.
- McGrath Road: There is a portion of McGrath Road that is not constructed (approx. 1.7 mi.) from the south boundary of the Boonesborough Subdivision to the entrance to the City of Bend treatment plant.
- Rickard Road: The last 1.8 miles of this road are gravel from end of pavement to the intersection with US20.
- Wilt Road: The last 4.5 miles of this road are gravel from end of pavement to the County line.

Capacity Analysis

Transportation System Plans (TSPs) are to identify needs/risks of transportation systems. Instead of detailed project level analysis outlined in Transportation Planning Analysis Unit's Analysis Procedure Manual (TPAU's APM), a system-level analysis was used for the Deschutes County TSP update. The analysis is based on the Deschutes County travel demand model along with other data to estimate deficiencies with a high, medium and low ranking. A high rank indicates a near-term project will be needed with a combination of the available funding. Medium and low ranks show need of a refinement plan for mid-term and long-term projects to be amended back into the TSP.

Capacity analysis of the TSP's roadways was performed using the Highway Economic Requirements System – State Version (HERS-ST). HERS-ST can be used in "need" analysis, program development or establishing performance objectives. HERS-ST analytical procedures rely on a Highway Performance Monitoring System (HPMS) database.

- State highways used existing 2006 HPMS data from ODOT's Integrated Transportation Information System (ITIS).
- County roadways use HPMS data developed from the base Deschutes County travel demand model (e.g. Annual Average Daily Traffic (AADT) volumes, speeds, number of lanes), data provided by Deschutes County (e.g. truck percentages), an assumed average K-factor of 15 percent and some national default values in the HERS-ST analytical program for unattainable data.

For county roads, the AADT volumes in HPMS were developed by post-processing the base 2003 Deschutes County Model (DCM) link's AADTs. Most of the base DCM link's AADTs were calibrated to reflect field counts, however some areas lack field counts, so those areas were adjusted using engineering judgment. Automatic Traffic Recorders (ATR) on state highways within Deschutes County shows a decreasing volume trend between 2004 and 2008. The cause may be from a combination of higher fuel prices and a slowing economy. County roads would likely follow the same decreasing trend, so the existing year volumes would be approximately equal to 2006. To obtain the 2006 AADTs for county roads, the base DCM link's AADT were adjusted based on a growth factor developed from Deschutes County field counts. For county roads without a growth factor, a two percent annual growth rate was applied.

The state highway mobility standards and the Deschutes County operational standards were used to rank segment deficiencies by high, medium and low. A process based on ODOT's Preliminary Signal Warrants (PSW) was used to rank intersections. Segments and/or intersections may have capacity, geometry or safety issues to be addressed in more detail in projects or refinement plans.

State Highway Segments

State highway mobility standards were developed for the 1999 Oregon Highway Plan (OHP) to measure traffic flow of state highways. The mobility standards are based on volume to capacity ratios. For a system-level TSP analysis, the estimated results for state highway segments should be ranked based on a range of the mobility standards between 0.60 and 0.80 (based on engineering judgment) in a format below:

- v/c < or = 0.60: Low risk
- 0.60 < v/c < 0.80: Medium risk
- v/c > or = 0.80: High risk

For existing conditions, the state highway analysis shows that no segments are at the High risk level, most are at the Low risk level (See Figures 4). Table 1 shows segments at the Medium risk level.

Table 1. Medium Risk State Highway Segments

Highway Name	Beginning Mile-point	Ending Mile-point	Average AADT[1]	Ranking Level	Functional Class
US97 (Hwy No. 4 - The Dalles – California)	115.23	117.34	16,300	Medium	Rural Principal Arterial
US97 (Hwy No. 4 - The Dalles – California)	151.05	153.08	17,100	Medium	Rural Principal Arterial
US20 (Hwy No. 17 - McKenzie – Bend)	14.48	14.72	14,700	Medium	Rural Principal Arterial
Hwy No. 370 – O'Neil	0.78	0.86	2,300	Medium	Rural Principal Arterial
Hwy No. 372 – Century Drive	10.62	11.75	2,500	Medium	Rural Principal Arterial
Hwy No. 372 – Century Drive	18.77	18.81	1,050	Medium	Rural Principal Arterial

[1] Average AADT estimated from 2006 HPMS database of records for state highways.

Deschutes County Road Segments

For existing Deschutes County roadways, the County operational standards are based on delay at the Level of Service D (LOS D). However, the Average Daily Traffic (ADT) thresholds for LOS D are 5,700 and 9,600. Therefore, roadway segments under the Deschutes County jurisdiction:

- Below LOS D threshold: Low risk
- Within LOS D: Medium risk
- Above LOS D threshold: High risk

Majority of existing Deschutes County roadway segments are at a Low risk level. Figure 4 shows the level of ranking for Deschutes County roads. Table 2 summarizes segment locations AADT, functional class and ranking.

Table 2. High and Medium Risk Deschutes County Segments

Segment or Roadway Name	From	To	Ranking	AADT[1]	Functional Class
Lower Bridge Way	31st Street	43rd Street	Medium	5800	Rural Collector
Deschutes Market Rd.	Dale Rd	Hamehook Rd	Medium	5800	Rural Collector
Baker Rd	Iroquois Circle	Apache Rd	Medium	5800	Urban Collector
Baker Rd	Apache Rd	Cinder Butte Rd	Medium	6800	Urban Collector
Baker Rd	Cinder Butte Rd	Southbound US97 Ramps	Medium	8800	Urban Collector
Baker Rd	Southbound US97 Ramps	Northbound US97 Ramp	Medium	9300	Urban Collector
Knott Rd	Northbound US97 Ramp	China Hat Rd	Medium	6700	Urban Arterial
South Century Dr	Spring River Rd	Venture Ln	Medium	6000	Rural Arterial
Burgess Rd	Huntington Rd	Day Rd	Medium	7400	Urban Collector

[1] AADT estimated from 2003 Deschutes County Model Version dated 3/23/09.

Intersections within the Deschutes County TSP analysis network

ODOT's Preliminary Signal Warrant (PSW) is used to evaluate signalization at an ADT level for an unsignalized intersection. Meeting the warrant does not mean a signal will be installed, but it indicates that the minor approaches will experience excessive delay or have substantial difficulty in entering or crossing the major street at an unsignalized intersection. As a part of the system analysis for the TSP, the PSW process was used to rank unsignalized intersections based on the approach's ADT volumes. Exceeding certain thresholds could indicate when an intersection improvement (not just including signals – i.e., roundabouts, turn restrictions, interchanges, etc.) would be necessary. Because of the sensitivity of the model volumes and the normal fluctuations in volumes, the following warrant thresholds to rank deficiency were used:

- Between 60% and 80% of threshold: Low risk
- Between 80% and 100% of threshold: Medium risk
- Greater than 100% of threshold: High risk

Figure 5 shows intersections with different levels of delay from minor approaches. The South Century Drive and US 97 intersection was fixed by a new interchange and the South Century Drive and Abbott Road interchange was fixed with a roundabout. Table 3 summarized intersection locations and their level of ranking.

Table 3. Intersection Risk Ranking

Intersection Locations	Ranking
Old Bend-Redmond Hwy / US20	High
Powell Butte Hwy / US20	High
US97 SB On/Off Ramp / Baker Rd	High
Knott Rd / US97 NB Off Ramp / Baker Rd	High
Cook Ave / US20 / O B Riley Rd	High
Neff Rd / Powell Butte Hwy / Alfalfa Market Rd	High
SW/NW Helmholtz Way / OR 126	High
Pershall Way / US97 / O. Neil Hwy	High
US97 / Vandevert Rd	High
US97 / Lower Bridge Way	High
US97 / South Century Dr[1]	High
Butler Market Rd / Powell Butte Hwy	Medium
South Century Dr / Abbott Rd[2]	Medium
Dalles California Hwy / Smith Rock Way	Medium
Fremont Hwy / Dalles California Hwy (US97)	Medium
Tumalo Rd / Cline Falls Hwy / Cook Ave	Medium
Hamby Rd / US20	Low
South Century Dr / Vandevert Rd	Low
South Century Dr / Spring River Rd	Low
US97 / Tumalo Rd / Deschutes Market Rd	Low

[1] This intersection has been fixed by a new interchange.
[2] This intersection has been fixed by a new roundabout.

Safety Analysis

A segment and intersection safety analysis was performed to identify poor geometric or operating conditions outside of capacity-related elements. Poor conditions are often indicated by patterns in the type of crash or level of severity. This analysis is based on official reported crash data from ODOT (there may be crashes not accounted for in ODOT data). Differences between state and local data are because of the investigative agency that reported to the crash scene or the crash not being reported by citizens involved.

State Highways

The crash data was analyzed for type, severity, location, crash rates, and the Safety Priority Index System (SPIS). SPIS was developed in 1986 by ODOT for identifying potential safety problems on state highways, where safety money may be spent to the highest benefit. The crash rate, expressed in crashes per million vehicle-miles traveled, is used to compare the crash experience of one roadway segment to another. This rate expresses how many crashes might be expected of vehicles traveling through a particular section of roadway for a cumulative total of one million miles. The SPIS score is calculated based on three years of crash data and considers crash frequency, crash rate, and crash severity. The SPIS score is computed for a roadway segment that is one tenth of a mile in length. A roadway segment becomes a SPIS site if:

- A location has three or more crashes; or
- One or more Injury-A (life-threatening); or
- A fatal crash over the three year period.

For state highways, a Crash Summary Database (CSD) program is created annually by ODOT. It is used in evaluating sections of highways and yields information for sections of highways regarding highest and lowest SPIS values, crash rates, traffic information and number and type of crashes. The analysis of the CSD program is based on three years of crash data (2005 – 2007). The CSD crash rates will be compared to a three year (2005 – 2007) average of the published rural highway system rates by functional class. Tables 4 and 5 summarize the crash rates, SPIS and the important patterns that emerged. Figure 6 shows 2005 – 2007 crashes and Top 10% SPIS sites on state highways.

Deschutes County classifies all state highways as rural principal arterials. For the purpose of the crash analysis, state classifications on state highways will be used.

Of the 626 reported crashes on state highways in Deschutes County between 2005 and 2007, the majority of crashes were fixed object collisions (44%). These fixed object crashes may be caused by lack of illumination, poor pavement conditions, poor weather conditions, driver fatigue, etc. Other collision types ranged from 5 to 20 percent. The vast majority (79%) of crashes were under daylight conditions. About half of the crashes occurred under snow, ice, or wet conditions. About a quarter of crashes occurred at intersections. The total crashes involving trucks were eight percent.

Outside of UGBs, there are four top 10% SPIS sites on state highways in Deschutes County, one on US20 (McKenzie – Bend) and three on US97.

- US 20, MP 14.53 and 14.71: This intersection of US20 at Bailey Road/7th Street is in the community of Tumalo. Of the seventeen 2005 – 2007 reported crashes, eight were turnings, six were angles, one was rear-end and two were fixed objects. There were also three severe Injury-A crashes. Right–in/out or other turn restrictions should be considered to improve safety.
- US97, MP128.49 - 128.67: This intersection of US97 at 61st Street/Deschutes Pleasant Ridge Road has 12 crashes reported between 2005 and 2007, 42 percent were rear-end, 26 percent were turning and 16 percent were angle and sideswipe-overtaking. The crash severity includes one fatal, and two Injury-As. Countermeasures could include an over-crossing or right-in-right-out turn restrictions.
- US97, MP 146.39 - 146.56: Of the six 2005 - 2007 reported crashes, there were two head-ons, two rear-ends, one sideswipe-overtaking and one fix-object. The crash severity includes one fatal and one Injury-A. Raised median barriers should be considered to improve safety at this location.
- US97, MP 168.10 - 168.28: This intersection of US97 at 6th Street divides Deschutes County and City of LaPine jurisdictions. Two out of seven 2005 – 2007 reported crashes were angle crashes, and the rest were turning crashes. The crash severity includes one fatal and one Injury-A. This location is within a transition of rural and urban areas. These type of crashes occur when drivers from the crossroad misjudge oncoming

vehicle speed on the highway because highway vehicles speed up as they enter the rural area. Modification to the current striping and signing to warn drivers the changes in travel lanes and in the culture on US97 have already been considered at this location.

Table 4. 2005 - 2007 State Highway Crash Rates[1]

Segment	ADT[6]	CSD 3-yr Crash Rate	Averaged Rural Hwy System Rates	Type of Crash						
				Head On	Angle	Turn	Rear End	Side Swipe	Fixed Object	Misc[5]
US97 Hwy No. 4 - The Dalles – California										
MP 112.86 - 119.02	14,400	0.55		4	4	12	20	2	6	5
MP 124.41 - 130.18	29,400	0.30		2	3	4	13	8	16	9
MP 130.18 - 132.19	27,500	0.30		2	1	1	5	1	5	3
MP 132.19 - 133.56	27,500	0.24		2	0	1	0	2	2	3
MP 142.24 - 143.47	22,200	0.37	**0.71[2]**	0	1	2	2	2	2	2
MP 143.47 - 150.71	17,100	0.40		4	1	0	5	5	33	6
MP 150.71 - 162.67	13,250	0.59		7	4	12	17	11	43	8
MP 162.67 - 164.19	9,400	0.45		0	0	1	0	2	2	2
MP 168.18 - 169.68	6,650	**1.10**		1	2	4	1	1	3	0
OR242/126 Hwy No. 15 - McKenzie										
MP 77.14 - 91.11	535	**1.34**	**1.17[3]**	1	1	1	1	2	5	0
MP 93.38 - 107.77	5,150	0.55	**0.71**	1	0	7	6	2	19	10
MP 107.77 - 110.15	11,000	**0.94**		0	4	9	6	0	4	4
US20 Hwy No. 16 - Santiam										
MP 90.85 - 92.85	5,100	**1.34**		1	0	1	3	1	8	1
MP 92.85 - 94.95	6,550	0.60	**0.71**	0	0	0	2	0	4	3
MP 94.95 - 100.12	10,400	0.61		1	2	2	5	4	17	5
US20 Hwy No. 17 - McKenzie - Bend										
MP 0.00 - 4.04	8,700	0.57		0	0	2	4	2	8	6
MP 4.04 - 5.30	8,700	0.67		0	0	0	3	0	4	1
MP 5.30 - 7.87	8,700	**0.90**		0	1	0	6	2	9	4
MP 7.87 - 9.72	9,100	**1.19**	**0.71**	2	0	1	4	1	9	5
MP 9.72 - 12.28	9,500	0.64		0	0	2	4	2	5	4
MP 12.28 - 14.30	9,500	0.33		0	0	1	1	0	3	2
MP 14.30 - 17.48	13,600	**0.84**		1	7	12	3	3	7	7
OR31 Hwy No. 19 - Fremont										
MP 0.00 – 2.31	1,900	**1.46**	**0.99[4]**	0	0	0	2	0	4	1
OR126 Hwy No. 41 - Ochoco										
MP 2.32 - 3.58	8,100	0.45	**0.71**	0	0	0	2	0	3	0
US20 Hwy No. 7 - Central Oregon										
MP 3.05 - 4.80	12,450	0.59		1	4	4	1	0	1	3
MP 4.80 - 9.16	3,250	**0.97**		0	5	1	1	0	5	3
MP 9.16 - 20.56	2,600	0.18	**0.71**	0	0	1	0	0	3	2
MP 20.56 - 35.65	1,550	0.35		0	0	0	0	2	6	1
MP 35.65 - 42.64	1,500	0.35		0	0	0	0	2	2	0
MP 42.64 - 69.25	1,500	0.39		0	0	0	1	0	12	4

Segment	ADT[6]	CSD 3-yr Crash Rate	Averaged Rural Hwy System Rates	Type of Crash						
				Head On	Angle	Turn	Rear End	Side Swipe	Fixed Object	Misc[5]
Hwy No. 370 – O'Neil										
MP 0.00 - 3.84	1,950	**1.10**	**0.99[4]**	0	2	2	0	0	3	2
Hwy No. 372 – Century Drive										
MP 4.63 - 7.19	8,500	0.25	**0.99**	1	0	0	1	0	4	0
MP 7.19 - 8.43	3,750	0.98		1	0	0	2	0	2	0
MP 8.43 - 11.43	2,500	**1.34**		1	0	0	1	2	5	2
MP 11.43 - 16.87	2,100	**1.04**		0	1	0	2	1	7	2
MP 16.87 - 19.19	2,100	**1.50**		0	1	1	2	0	4	0
MP 19.19 - 21.98	2,000	**1.64**		0	0	3	0	2	5	0

[1] Black shaded cells indicate that the three year average of the published rural highway system crash rates were exceeded.
[2] Three year average of the published rural highway system crash rates for rural principal arterials.
[3] Three year average of the published rural highway system crash rates for rural major collectors.
[4] Three year average of the published rural highway system crash rates for rural minor arterials.
[5] Miscellaneous crashes also include pedestrian, backing, parking, and non-collision crash types.
[6] The ADT is taken from the middle year of the three years of data reviewed.

Table 5. 2005 - 2007 State Highway Crash Severity

Segment[1]	Crash Severity		
	PDO[2]	INJ[3]	FAT[4]
US97 Hwy No. 4 - The Dalles – California			
MP 112.86 - 119.02	25	26	2
MP 124.41 - 130.18	28	26	1
MP 130.18 - 132.19	7	11	0
MP 132.19 - 133.56	6	4	0
MP 142.24 - 143.47	6	5	0
MP 143.47 - 150.71	30	22	2
MP 150.71 - 162.67	48	50	4
MP 162.67 - 164.19	6	1	0
MP 168.18 - 169.68	5	5	2
OR242/126 Hwy No. 15 - McKenzie			
MP 77.14 - 91.11	7	4	0
MP 93.38 - 107.77	24	21	0
MP 107.77 - 110.15	9	18	0
US20 Hwy No. 16 - Santiam			
MP 90.85 - 92.85	9	6	0
MP 92.85 - 94.95	6	3	0
MP 94.95 - 100.12	20	16	0
US20 Hwy No. 17 - McKenzie - Bend			
MP 0.00 - 4.04	11	11	0
MP 4.04 - 5.30	4	4	0
MP 5.30 - 7.87	7	15	0
MP 7.87 - 9.72	12	9	1
MP 9.72 - 12.28	10	5	2
MP 12.28 - 14.30	5	1	1

Segment[1]	Crash Severity		
	PDO[2]	INJ[3]	FAT[4]
MP 14.30 - 17.48	18	22	0
OR31 Hwy No. 19 - Fremont			
MP 0.00 – 2.31	4	3	0
OR126 Hwy No. 41 - Ochoco			
MP 2.32 - 3.58	2	3	0
US20 Hwy No. 7 - Central Oregon			
MP 3.05 - 4.80	6	8	0
MP 4.80 - 9.16	6	8	1
MP 9.16 - 20.56	3	3	0
MP 20.56 - 35.65	4	5	0
MP 35.65 - 42.64	2	2	0
MP 42.64 - 69.25	8	9	0
Hwy No. 370 - O'Neil Highway			
MP 2.32 - 3.58	5	4	0
Hwy No. 372 – Century Drive			
MP 4.63 - 7.19	3	3	0
MP 7.19 - 8.43	4	1	0
MP 8.43 - 11.43	9	2	0
MP 11.43 - 16.87	6	7	0
MP 16.87 - 19.19	6	2	0
MP 19.19 - 21.98	7	3	0

[1] Black shaded cell indicates the segment is a Top 10% SPIS site.
[2] PDO = Property Damage Only
[3] INJ = Injury
[4] FAT = Fatality

Two segments on the McKenzie Highway, one on OR242 and one on OR126 east of Sisters, have CSD three year crash rates exceeding three year average of the published rural highway system rates.

- OR242, MP 77.14 - MP 91.11: The majority of crashes on this rural major collector occurred on wet and icy roadway conditions. Weather advisory signs/message boards should be considered.
- OR126, MP 107.77 - MP 110.15: This roadway is a rural principal arterial and within the urban fringe area of Redmond. The majority of crashes on this segment were angle, turn and rear-end collision types which occurred during good weather with a dry roadway surface condition and at intersections and accesses. Consolidated accesses, channelized turn bays and raised median barriers should be considered for this segment.

US 20, MP 90.85 - MP 92.85, west of Sisters: This rural principal arterial exceeds the three year average of the published rural highway system rates. A majority of crashes were rear-end and fixed object collisions. Thirteen out of fifteen total crashes occurred on wet, snowy or icy roadway surface conditions. Weather advisory signs/message boards should be considered for this segment.

US 20, MP 5.30 - MP 9.72, east of Sisters: This rural principal arterial exceeds the three year average of the published rural highway system rates. Thirty out of forty-two total crashes occurred under dry conditions. Majority of crashes were rear-end, side-swipe and fixed objects. One head-on fatality crash occurred during dry daylight conditions. Errors in the crash reports included: followed too close, driving too fast, fatigued, careless driving, and inattention. Law enforcement and speed advisories should be considered for this segment. Raised barriers may also be considered to eliminate the potential head-on crash potential.

OR31, MP 0.00 - MP 2.31: This rural minor arterial exceeds the three year average of the published rural highway system rates. Four out of the seven total crashes were fixed object collisions. The majority of crashes were related to driving too fast and following too close. Law enforcement and speed advisories should be considered for this segment.

US 20, MP 4.80 - MP 9.16, east of Bend: This rural principal arterial exceeds the three year average of the published rural highway system rates. One-third of the total crashes were angle and fixed objects. Seventy five percent of crashes occurred during dry conditions. Driver's errors included: driving too fast, following too close, and improper turning. Law enforcement and speed advisory should be considered for this segment.

OR370, MP 0.00 - MP 3.84, O'Neil Highway (Hwy 370): This rural minor arterial exceeds the three year average of the published rural highway system rates. Most of the nine total crashes involved driving too fast and alcohol. Law enforcement and speed advisory should be considered.

Century Drive (Hwy 372), MP 8.43 - 21.98: This rural minor arterial exceeds the three year average of the published rural highway system rates. Of the 42 crashes, 21 were fixed object crashes. Thirty-six crashes occurred with wet, snowy or icy roadway surface conditions. Weather advisories should be considered for this segment.

Deschutes County Roads

The county crash data is obtained from official ODOT crash reports, as with the state highways. However, due to the lack of accurate crash locations on county roadways, crash data were reviewed and located on the county road network in large segments. In addition, legislative changes to the Department of Motor Vehicles crash reporting requirements, effective January 1, 2004, may result in less Property Damage Only (PDO) crashes being eligible for inclusion in the Statewide Crash Data File. County crash analyses were conducted at intersections and on roadway segments. Analyzed intersection crashes were not included on segment analysis to avoid duplication. Figure 7 shows 2002 – 2006 crashes on roadways under Deschutes County jurisdiction.

<u>Intersections under Deschutes County Jurisdiction</u>

Table 6 summarizes intersections with crash rates greater than 0.50. The intersection crash rate, expressed in "crashes per million entering vehicles", is used to compare the crash rate of one intersection to another. Intersection crash rates greater than 1.0 indicate potential safety issues and the need for further investigation.

Table 6. 2002 - 2006 Deschutes County Intersection Crash Rates[1]

Intersection Location	Intersection Crashes	Entering ADT	Intersection Crash Rate
Hamby Rd & Neff Rd	21	4150	**2.77**
Coyner Ave & Northwest Way	8	3550	**1.24**
Old Bend-Redmond Hwy & Tumalo Rd	9	4550	**1.08**
South Century Dr & Spring River Rd	6	5050	0.66
Neff Rd & Powell Butte Hwy & Alfalfa Market Rd	10	9050	0.61
Gosney Rd & Rickard Rd	2	2150	0.52
Hamehook Rd & Deschutes Market Rd	4	4350	0.51
Butler Market Rd & Powell Butte Hwy	7	7650	0.50

[1] Black shaded cell indicates the intersection exceeds a crash rate of 1.0.

The three intersections shown below exceeded the 1.0 crash rate threshold.

NE Neff Road at Hamby Road. There were a total of 21 crashes at this location between 2002 and 2006:

- 33% (7) fatal crashes
- 10% (2) Injury-A crashes
- 39% injury crashes (including A)
- 29% Property Damage Only (PDO) crashes
- 86% occurred in daylight conditions
- 81% (17) were angle collisions
- 19% (4) were turn movement
- No pedestrian crashes

A high number of crashes occurred in 2002, with an average of five crashes per year from 2003 to 2006. The crash data shows that the vast majority of the crashes occurred in dry daylight conditions. Over a third of the crashes occurred between 9:00 AM and 12:00 PM. All of the collision types were angle or turning. Angle collisions (17) included seven fatalities and one Injury-A crash. The four turning collisions included two fatalities and one Injury-A crash. All of the crashes occurred because the drivers failed to yield the right-of-way. Improvements have already been made at this intersection in the form of installing four-way stop control. This should improve the safety of the angle or turning maneuvers. If needed, additional countermeasures may include clearing sight distance and roadside shoulders.

Coyner Road at Northwest Way. There were a total of 8 crashes at this location between 2002 and 2006:

- 13% (1) fatal crashes
- 25% (2) Injury-A crashes
- 38% injury crashes (including A)
- 50% Property Damage Only (PDO) crashes
- 100% occurred in daylight
- 75% (6) were angle collisions
- No pedestrian crashes
-

Three crashes or less occurred per year from 2002 to 2006. All of the crashes occurred under dry daylight conditions. About two-thirds of the crashes occurred in the afternoon peak period from 3:00 PM to 6:00 PM and three-quarters occurred in the last half of the week.

The single fatality was an angle collision that occurred in 2002 when a driver failed to stop at a stop sign. One Injury-A crash was a turning collision, a vehicle improperly overtook another. The other Injury-A crash was a rear end collision. The inattentive driver was traveling too fast for conditions, but not exceeding the posted speed. The impacted vehicle was forced into the vehicle in front. Improvements have already been made at this intersection, in the form of installing flashing lights to the stop signs. If needed, additional countermeasures may include clearing sight distance and roadside shoulders.

Old Bend-Redmond Highway at Tumalo Road. There were a total of 9 crashes at this location between 2002 and 2006:

- 22% (2) fatal crashes
- 11% (1) Injury-A crashes
- 56% injury crashes (including A)
- 44% Property Damage Only (PDO) crashes
- 78% occurred in daylight
- 11% (1) were rear-end collisions
- 22% (2) were turn movement
- 11% (1) were fixed object collisions
- 56% (5) were angle collisions
- No pedestrian crashes

There have been two to three crashes per year from 2002 to 2006. The crash data shows that half of the crashes occurred in the afternoon peak period between 3:00 PM and 6:00 PM, and that two-thirds occurred in the last half of the week. About two-thirds of the crashes occurred in dry conditions and over three-quarters in daylight.

One fatality was an angle collision. One vehicle failed to stop at a stop sign in the early morning on a dry roadway. The other fatality was a fixed object collision where the vehicle was traveling too fast for the icy conditions, but was not exceeding the posted speed. The Injury-A crash was a rear-end collision, under dry, daylight conditions where the driver was following too closely and could not respond quickly enough (cell-phone use involved) to livestock blocking the roadway.

Deschutes County Roadway Segments

Table 7 summarizes Deschutes County roadway segments with crash rates greater than 0.50 by functional class.

Table 7. 2002 - 2006 Deschutes County Roadway Segment Crash Rates[1]

Road Name	Crash Total	Weighted ADT	Roadway Length	Crash Rate	Functional Class
Pershall Way	6	650	3.3	**1.56**	Rural Major Collector
North Canal Blvd	2	300	3.0	**1.35**	Rural Major Collector
Hamby Rd	14	1250	4.8	**1.27**	Urban Collector
Canal Blvd	25	2150	6.8	0.94	Rural Major Collector
Johnson Ranch Rd	2	150	8.0	0.93	Rural Major Collector
Burgess Rd	59	3600	10.2	**0.89**	Urban Collector
Paulina Lake Rd	2	50	34.8	0.85	Rural Major Collector
Wilcox Ave	2	250	5.5	0.81	Rural Major Collector
Alfalfa Market Rd	30	1200	18.9	0.73	Rural Major Collector
Coyner Ave	4	1350	2.5	0.66	Rural Major Collector
Cannal Blvd	1	1950	0.4	0.64	Urban Minor Arterial
Huntington Rd	11	1250	7.8	0.63	Rural Major Collector
Butler Market Rd	13	2750	4.8	0.55	Rural Major Collector
Skyliners Rd	5	350	15.4	0.53	Rural Major Collector
Deschutes Market Rd	33	4200	8.4	0.51	Rural Major Collector
South Century Dr	17	4300	4.3	0.51	Rural Minor Arterial

[1] Black shaded cells indicate that the 2007 published rural/urban area's highway system crash rates were exceeded.

Based on Table 2 on page 7 of the 2007 State Highway Crash Rate Table (five-year comparison of state highway crash rates), the 2007 published rural/urban area's highway system crash rates are:

- 1.24 for rural major collectors
- 0.86 for urban collectors

These 2007 published rural/urban area's highway system crash rates were compared to Deschutes County roadway segment crash rates. Any county roadway segment crash rate greater than the 2007 published rural/urban area's highway system crash rates for that classification indicates potential safety issues that need further investigation.

Burgess Road (from US97 to Ponderosa Way). The Burgess Road segment outside of the La Pine city limits has a large number of fatalities (9). The crashes are mostly angle, turning, and rear-end collisions with about half occurring at intersections and about half occurring under winter conditions. Trends show that the number of crashes will increase with time. There are two high crash locations within this segment:

- Burgess Road, where it abruptly curves from an east/west to a southeast/northwest orientation, has been the scene of several crashes. The curve occurs between Sunrise Boulevard and Primrose Lane. This section should be investigated for geometric improvements.

- The intersection of Day Road and Burgess Road is incurring multiple crashes. The turning fatality crash occurred on a dry surface in daylight hours. The driver did not yield the right-of-way. There were no pedestrian collisions. The Injury-A crash was a fixed object collision that occurred on ice in the early morning. Countermeasures could include: limiting street access/turns, improved intersection traffic control, constructing medians, and improving roadway geometrics (shoulders, clear zones, sight distance, etc).

Deschutes County Public Works specifically requested that the section of Burgess Road within the La Pine UGB be analyzed without splitting the Huntington Road/Burgess Road intersection out, deviating from the TSP safety analysis procedures and methodology. There are a large number of crashes on Burgess Road inside the La Pine UGB. However, the majority (27 of 34) of crashes occurred at the intersection of Burgess Road and Huntington Road. On Burgess Road, two crashes occurred between the La Pine UGB and Huntington Road and four were between Huntington Road and US97.

At the intersection of Burgess Road and Huntington Road, four of the six fatal crashes were turn collisions. All fatal and Injury-A crashes occurred during daylight hours. One fatal crash and half of the turning crashes occurred in inclement conditions. The causes were mainly failure to yield the right-of-way or traveling too fast for conditions. There were no pedestrian collisions. Deschutes County plans to signalize this intersection which should reduce the severity and number of turning crashes.

Hamby Road. There were fourteen crashes in this section, most of them occurring in dry, dark conditions. None of the crashes involved a fatality. All but four of the segment crashes were fixed object crashes. Of the four, two were pedestrian crashes; the other two were angle and rear-end crashes. The crashes were attributed to some form of improper driving, speeding, following too closely or inattention. Alcohol was only involved in one of the crashes. Countermeasures including recoverable slopes, clear zones and shoulder improvements should be considered.

Pershall Way. There were six crashes on this roadway. Two were fixed object collisions, two were non-collision crashes (phantom vehicle) and two were rear-end collisions. All but the fixed object crashes were Property Damage Only (PDO) collisions. There were no fatalities. The weather was clear for all crashes. Icy roadways were a factor in two crashes. All but one crash occurred in daylight. The crashes were attributed to improper driving, reckless driving, speeding, following too closely and

inattention. Recoverable slopes absent of rocks, fences or other obstacles would have been of benefit to half of these crashes.

North Canal Boulevard. Two crashes occurred on this roadway, both under clear dry daylight conditions. A fixed object crash near US97 was caused by driving too fast for conditions. The other crash on this roadway was a sideswipe-overtaking crash attributed to improper passing.

cc: Peter Schuytema, TPAU
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STATE OF OREGON **INTEROFFICE MEMO**

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File Code:

Date: July 12, 2010

TO: Peter Russell
Deschutes County Planning Division

FROM: Thanh Nguyen, PE, Senior Transportation System Analyst
Transportation Planning Analysis Unit

SUBJECT: Deschutes County Transportation System Plan Update (TSP)
Updated Technical Memo # 3 – 2030 Future Traffic Conditions

The purpose of this technical memorandum is to update and document the results for the 2030 future traffic conditions by ranking roadway network intersections and segments by low, medium, and high. The ranking process was introduced in Technical Memorandum # 2 - Existing Traffic Conditions, dated 7/24/2009.

Travel Demand Forecasting Model

The Deschutes County travel demand model relies on socioeconomic data (e.g., population and employment) to determine travel demand and system attributes (e.g., capacity, speeds, distances) to represent the transportation supply. The Deschutes County travel demand model has a base year of 2003 and a horizon year of 2030.

Deschutes County provided base and horizon years' population and employment information. The horizon year (2030) population and employment forecast distributions were derived by the land use model – LUSDR (Land Use Scenario DevelopR) developed by ODOT. Two guiding assumptions for the Deschutes County modeling effort greatly simplified the land use model:

1) The future population and employment allocations for Bend, Redmond and Sisters are assumed as given in their models.
2) It is assumed that there will be no increase in employment outside of the urban model areas except in destination resorts.

Given these assumptions, the land use model for Deschutes County simplifies to that of allocating residential dwelling units to Transportation Analysis Zones (TAZ) located outside of the urban model areas. The Deschutes County land use model also accounts for the development of recreational and second homes in destination resorts and elsewhere in the study area. For the model area, there is an estimation of 134,655 future households which were synthesized from the future population that was from the official Office of Economic Analysis projections. The development of recreational and second homes is estimated about 13.7 percent of the total future households in the

study area. These developments significantly contribute to vehicle travel and also to the amount of employment occurring in destination resorts and need to be modeled.

The Deschutes County land use model also makes general allocations of households and employment to Crook and Jefferson counties. The transportation model includes those areas in order to provide better traffic predictions at the Deschutes County boundary. These counties are also important to the allocation of recreational and second home development since Deschutes County is part of the overall Central Oregon market for these types of developments. However, the forecasts are not made at the geographic level of detail of places within Deschutes County because it is unnecessary to do so in order to achieve the above objectives.

The Deschutes County LUSDR model generated 30 different population and employment forecast distributions (scenarios) for 2030. These were then input into the 2030 Deschutes County travel demand model to determine the traffic demand on the various links for each of the 30 scenarios. Coefficients of variation were calculated for each link. The coefficient of variation measures how much a particular link volume changes over the different land use scenarios. In order to do this, each scenario was run in the model to distribute the 2030 population and employment forecasted numbers and to create link volumes. A coefficient of variation of up to ten percent is desirable. Figure 1 shows the distribution of the link's coefficient of variation. On links with coefficients of variation over ten percent, further investigations indicated that those links have low annual average daily traffic volumes (See Figure 2) and the majority of these links are off of the transportation system plan (TSP) study network. On roads with low volumes, any change can yield a high variation. The analysis results indicated no significant impacts on link demand among the 30 distributions, so they were averaged together into a single future scenario to be used in the 2030 Deschutes County demand model for future analysis.

Future Average Annual Daily Traffic Forecast

The future average annual daily traffic (AADT) forecasting process was based on the Deschutes County travel demand model. The future AADTs were developed by following the NCHRP Report 255 difference method outlined in ODOT's Analysis Procedure Manual. An AADT difference for each link was calculated from comparing the Deschutes County base year and horizon year demand models. The future AADTs are the sum between the base existing condition AADTs (from Technical Memorandum # 2) and the calculated links' AADT differences. The future AADTs forecasts allow an assessment of potential roadway capacity issues.

Future Traffic Conditions

The year 2030 traffic projections are used as a planning tool to help test the ability of existing roadways to accommodate 2030 AADTs. In addition to the number of lanes, the daily capacity of any individual roadway segment is based upon many factors, for example, number of lanes, number of access points per mile, and percent of truck traffic. For planning purposes on Deschutes County roadways, the analysis uses generalized volume to capacity (v/c) ratio thresholds for state highway segments, generalized AADT thresholds for the Deschutes County roadways, and preliminary signal warrants (PSW) thresholds for intersections.

For state highway segments should be ranked based on a range of the mobility standards between 0.60 and 0.80 (based on engineering judgment) in a format below:

- v/c < or = 0.60: Low risk
- 0.60 < v/c < 0.80: Medium risk
- v/c > or = 0.80: High risk

For county roads, the County's operational standard is based on delay. The County defines Level of Service (LOS) D as acceptable for existing County roads. The County for a roadway segment defines LOS D as between 5,700 and 9,600 ADT. Therefore, roadway segments under the Deschutes County jurisdiction:

- Below LOS D threshold: Low risk
- Within LOS D: Medium risk
- Above LOS D: High risk.

ODOT's Preliminary Signal Warrant (PSW) is used to evaluate signalization at an ADT level for an unsignalized intersection. Meeting the warrant does not mean a signal will be installed, but it indicates that the minor approaches will experience excessive delay or have substantial difficulty in entering or crossing the major street at an unsignalized intersection. As a part of the system analysis for the TSP, the PSW process was used to rank unsignalized intersections based on the approach's ADT volumes. Exceeding certain thresholds could indicate when an intersection improvement (not just including signals – i.e., roundabouts, turn restrictions, interchanges, etc.) would be necessary. Because of the sensitivity of the model volumes and the normal fluctuations in volumes, the following warrant thresholds to rank deficiency were used:

- Between 60% and 80% of threshold: Low risk
- Between 80% and 100% of threshold: Medium risk
- Greater than 100% of threshold: High risk

These thresholds are qualitative measures describing operational conditions within a traffic stream, generally in terms of speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience.

State Highway Segments

The review of the future v/c ratios on state highways as tested against the generalized v/c thresholds indicates that many state highway segments are in high need of future capacity improvements. Table 1 summarizes state highways segments at the high and medium needs level. Figures 3-8 show the level of ranking for State Highway segments.

State highways are principal arterials and have a function of accommodating larger volumes of traffic and at higher speeds; therefore ODOT needs to identify a near/mid term projects list for capacity improvements for segments in the high and medium needs category for inclusion in the Deschutes County TSP. Corridor refinement plans could also assist in identifying projects list for segments in high and medium needs category. A plan for capacity improvements does not only include adding lanes or changing physical geometry on state highways but also manages accesses along these state corridors. Access to such facilities must be limited in order to protect the integrity of the roadway. As numerous studies have shown that as the density of access increases, whether public

or private, the traffic carrying capacity of the roadway decreases and the vehicular crash rate increases. Additionally, ODOT in the Oregon Highway Plan (OHP) at 3B calls for raised medians when ADT exceeds 28,000 vehicles as a countermeasure to prevent certain types of crashes, primarily head-ons as well as broadsides from turning movements. Several multilane portions of US 97 will exceed that threshold, while remaining at adequate through capacity.

Table 1. Need Ranking on State Highway Segments

Highway Name	Beginning Mile-point	Ending Mile-point	From	To	Directional Number of Lanes	AADT[1]	V/C Ratio[2]	Ranking Level	Functional Classification
US 20 (Hwy No. 7) - Central Oregon Highway	3.01	3.22	Providence Drive	0.35 mi west of Hamby Road	1	15900	0.97	High	Urban Arterial
	3.22	3.58	0.35 mi west of Hamby Road	Hamby Road	1	12400	0.83	High	Urban Arterial
US 97 (Hwy No. 4) - Dalles California Highway	114.24	115.19	Wimp Way	Lower Bridge Way/11th Street (North)	1	17600	0.95	High	Rural Arterial
	115.19	115.5	Lower Bridge Way/11th Street (North)	E Avenue	1	22700	1.07	High	Rural Arterial
	115.50	115.66	E Avenue	C Avenue	1	21800	1.08	High	Rural Arterial
	115.66	115.83	C Avenue	0.08 mi north of 11th Avenue (South)	1	24700	1.18	High	Rural Arterial
	115.83	115.91	0.08 mi north of 11th Avenue (South)	11th Avenue (South)	1	23400	1.10	High	Rural Arterial
	115.91	117.43	11th Avenue (South)	Galloway Avenue	1	25100	1.19	High	Rural Arterial
	117.43	118.53	Galloway Avenue	Pershall Way/O'Neil Highway	1*	24400	1.15	High	Rural Arterial
	151.05	153.05	SB Off Ramp at Cottonwood Road	South Century Drive	1*	23200	1.19	High	Rural Arterial
	153.05	155.48	South Century Drive	Vandevert Road	1	19100	1.02	High	Rural Arterial
	155.48	160.56	Vandevert Road	LaPine State Recreation/Fish Hook Rd	1	16400	0.95	High	Rural Arterial
	160.56	162.64	LaPine State Recreation/Fish Hook Rd	Pine Crest Lane	1	14400	0.86	High	Rural Arterial
	162.64	164.17	Pine Crest Lane	Drafter Road	1	15100	0.87	High	Urban Arterial
OR 126 (Hwy No. 15) - McKenzie Highway	99.90	101.91	Quail Tree Drive	2 mi east of Quail Tree Drive	1	7300	1.18	High	Rural Arterial
	107.98	110.27	Cline Falls Highway Ramps	NW Helmholtz Way	1	18900	1.00	High	Rural Arterial
	110.27	110.77	NW Helmholtz Way	35th Street	1	21000	1.03	High	Rural Arterial
US 20 (Hwy No. 17) - McKenzie Bend Highway	12.26	13.7	Couch Market Road	Gerking Market Road	1	13800	0.82	High	Rural Arterial
	13.70	14.57	Gerking Market Road	Bailey Road/7th Street	1	15600	0.90	High	Rural Arterial
	14.57	15.43	Bailey Road/7th Street	0.76 mi south of OB Riley Road	1	19200	1.03	High	Rural Arterial
OR 126 (Hwy No. 41) - Ochoco Highway	2.32	3.05	Sherman Road	0.73 mi east of Sherman Road	1	16900	0.97	High	Rural Arterial
	3.05	3.62	0.73 mi east of Sherman Road	County Line (1.30 mi east of Sherman Road)	1	16600	0.95	High	Rural Arterial
Highway No. 370 - O'Neil Highway	0.40	0.9	Yucca Avenue	NE 5th Street	1	3000	0.94	High	Rural Arterial
US 20 (Hwy No. 16) - Santiam Highway	92.76	98.22	Hawks Beard	Tollgate	1	9900	0.83	High	Rural Arterial
	98.22	99.54	Tollgate	Rail Way	1	11900	0.98	High	Rural Arterial
US 20 (Hwy No. 7) - Central Oregon Highway	3.58	4.77	Hamby Road	Powell Butte Highway	1	10700	0.74	Medium	Rural Arterial
US 97 (Hwy No. 4) - Dalles California Highway	128.49	131.89	Deschutes Pleasant Ridge	0.45 mi north of Fort Thompson Lane	2	46300	0.67	Medium	Rural Arterial
	131.89	133.02	0.45 mi north of Fort Thompson Lane	Bowery Lane	2	45200	0.62	Medium	Rural Arterial
	133.02	133.64	Bowery Lane	Grandview Drive	2	50500	0.69	Medium	Urban Arterial
	168.21	169.65	6th Street	Highway 31	1	12200	0.76	Medium	Rural Arterial
	169.65	169.84	Highway 31	Masten Road	1	9500	0.65	Medium	Rural Arterial
	169.84	172.17	Masten Road	County Line (0.9 mi South of Jackpine Loop)	1	8200	0.64	Medium	Rural Arterial

OR 126 (Hwy No. 15) - McKenzie Highway	94.16	96.47	Creekside Court	Camp Polk Road	1	6700	0.64	Medium	Rural Arterial
	96.47	97.10	Camp Polk Road	Cloverdale Road	1	7700	0.68	Medium	Rural Arterial
	97.10	99.90	Cloverdale Road	Quail Tree Drive	1	7200	0.63	Medium	Rural Arterial
	101.91	104.32	2 mi east of Quail Tree Drive	Buckhorn/Barr Road	1	7300	0.63	Medium	Rural Arterial
	106.26	107.79	101st Street	Oaisis Drive	1	7700	0.64	Medium	Rural Arterial
	107.79	107.95	Oasis Drive	Cline Falls Highway Ramps	1	8400	0.62	Medium	Rural Arterial
US 20 (Hwy No. 17) - McKenzie Bend Highway	0.37	4.77	Desperado Trail	Cloverdale Road	1	8700	0.68	Medium	Rural Arterial
	4.77	4.91	Cloverdale Road	Gist/Cloverdale Road	1	11700	0.71	Medium	Rural Arterial
	4.91	7.49	Gist/Cloverdale Road	Plainview Road	1	10000	0.70	Medium	Rural Arterial
	7.49	7.82	Plainview Road	Fryrear Road	1	11200	0.68	Medium	Rural Arterial
	7.82	10.03	Fryrear Road	Tweed Road	1	12400	0.76	Medium	Rural Arterial
	10.70	12.26	0.67 mi eat of Tweed Road	Couch Market Road	1	12500	0.77	Medium	Rural Arterial
US 20 (Hwy No. 16) - Santiam Highway	90.76	90.78	County Line (0.02 mi north of Mcallister Rd)	Mcallister Road	1	5500	0.67	Medium	Rural Arterial
	90.78	92.76	Mcallister Road	Hawks Beard	1	6800	0.67	Medium	Rural Arterial
US 97 (Hwy No. 4) - Dalles California Highway	124.43	128.49	Redmond City Limits	Deschutes Pleasant Ridger	2	32150	0.44	Low	Rural Arterial
	142.25	143.29	Bend City Limits	Baker Road Interchange	2	30400	0.415	Low	Urban Arterial

[1] AADT estimated from 2030 Deschutes County Model Version dated 07/01/2010.
[2] HERS-ST calculated directional v/c ratios. The reported v//c ratios were averaged for both directions.
[*] Current STIP projects to fix.

Deschutes County Road Segments

The future planning-level AADTs on Deschutes County roads as tested against the generalized AADT thresholds indicate the majority of Deschutes County roadway segments are in the low need improvement category. There are few short segments of roadways such as Baker Road, Burgess Road, Canal Boulevard, Cline Falls Highway, Deschutes Market Road, and Northwest Way in the high need category.

There is a long stretch of Helmholtz Way between Maple Avenue and Canal Boulevard in the high need category. The future travel demand model indicates that the trips on Helmholtz Way accessing US97 through Sixty-first Street and Sherwood Road. Sixty-first Street and Sherwood Road are not included in the study because of their local county functional classification. The future AADTs on these two roadways are in 13000 vehicle range. Deschutes County needs to upgrade the future functional classification of these two roadways.

Figures 3-8 show the need ranking for Deschutes County roads. Table 2 summarizes segment locations AADT, functional class and ranking. Access to these segments would experience greater delay in the future.

19th Street new connection: The future travel demand model was rerun with the new 19th Street connection eastside of the railroad track and between Deschutes Market Road and SW Mountain Parkway. It has one lane in each direction and its speed is 55 mile per hour. The travel demand model indicates that only a half of one percent of US97 traffic will be diverted to it. Its AADT is around 230 vehicles. It has minimal benefit on the Deschutes County TSP network especially US97.

Table 2. Need Ranking on Deschutes County Segments

Segment or Roadway Name	From	To	Ranking	AADT[1]	LOS	Functional Classification
Baker Rd	Apache Rd	Cinder Butte Road	High	11100	E	Urban Collector
Burgess Rd	Meadow Ln	Huntington Rd	High	11200	E	Urban Collector
Burgess Rd	Day Rd	Meadow Ln	High	9800	E	Urban Collector
Canal Boulevard	61st Street/Quarry Ave	Helmholtz Way	High	16500	F	Rural Collector
Cline Falls Hwy	Nutcracker Dr	Southwest ramps terminal of OR 126 (Hwy No. 15)	High	11900	E	Rural Arterial
Deschutes Market Road	Hamehook Rd	Margaret Lane	High	10600	E	Rural Collector
Helmholtz Way	Canal Blvd	Elkhorn Ave	High	14200	E	Rural Collector
Helmholtz Way	Elkhorn Ave	Coyote Ave	High	11400	E	Rural Collector
Helmholtz Way	Coyote Ave	0.25 miles north of Wickiup Ave	High	14700	E	Rural Collector
Helmholtz Way	0.25 miles north of Wickiup Ave	Highway 126 - The McKenzie Hwy	High	17000	F	Rural Collector
Helmholtz Way	Highway 126 - The McKenzie Hwy	0.25 miles north of Highway 126 - McKenzie Highway	High	19700	F	Rural Collector
Helmholtz Way	0.25 miles north of Highway 126 - McKenzie Highway	0.25 miles north of Antler Ave	High	14000	E	Rural Collector
Helmholtz Way	0.25 miles north of Antler Ave	Maple Avenue	High	12000	E	Rural Collector
Northwest Way	Maple Ave	0.5 miles north of Maple Ave	High	17500	F	Rural Collector
Northwest Way	0.5 miles north of Maple Ave	Upas Ave	High	10800	E	Rural Collector
Baker Rd	US 97 (Hwy No. 4) Northbound Ramps	Scale House Road	Medium	7100	D	Urban Arterial
Burgess Rd	Antler Lane	Highway 97	Medium	6000	D	Urban Collector
Butler Market Road	Hamehook Rd	Silver Rd	Medium	6600	D	Rural Collector
Butler Market Road	Silver Rd	Powell Butte Hwy	Medium	6200	D	Rural Collector
Canal Boulevard	Elkhorn Ave	39th St	Medium	7800	D	Urban Arterial
Cline Falls Hwy	Cook Ave	Tumalo Road	Medium	7100	D	Rural Arterial
Cline Falls Hwy	Coopers Hawk Dr/Falcon Crest Dr	Nutcracker Dr	Medium	6700	D	Rural Arterial
Cook Ave	OB Riley Rd	Cline Falls Hwy	Medium	7000	D	Rural Arterial

Deschutes Market Road	Margaret Lane	Dale Rd	Medium	6200	D	Rural Collector
Knott Rd	Scale House Road	China Hat Rd	Medium	6800	D	Urban Arterial
Lower Bridge Way	43rd St	31st St	Medium	8800	D	Rural Collector
Lower Bridge Way	31st St	US 97 (Hwy No. 4)/ 11th St	Medium	6600	D	Rural Collector
Neff Road	Glacier Ridge Road	Hamby Road	Medium	5800	D	Urban Arterial
Northwest Way	Coyner Ave	Montgomery Ave	Medium	6000	D	Rural Collector
OB Riley Rd	Old Bend Redmond Hwy	Destiny Ct	Medium	8000	D	Rural Collector
Old Bend Redmond Hwy	OB Riley Rd	Highway 20 - McKenzie Highway	Medium	6900	D	Rural Collector
Powell Butte Highway	US 20 (Hwy. No. 7) - Central Oregon Highway	Neff Rd/Alfalfa Market Rd	Medium	7800	D	Rural Arterial
Powell Butte Highway	Neff Rd/Alfalfa Market Rd	Butler Market Rd	Medium	6400	D	Rural Arterial
Powell Butte Highway	Butler Market Rd	McGrath Road	Medium	8400	D	Rural Arterial
Powell Butte Highway	McGrath Road	Morril Rd	Medium	7600	D	Rural Arterial
Powell Butte Highway	Morril Rd	County Line	Medium	6700	D	Rural Arterial
South Century Dr	Lazy River Dr	Vandevert Rd	Medium	7100	D	Rural Collector
South Century Dr	Spring River Rd	Abbott Road	Medium	8700	D	Rural Collector
Spring River Rd	Solar Dr	South Century Dr	Medium	5700	D	Rural Arterial

[1] AADT estimated from 2030 Deschutes County Model Version dated 07/01/2010.

Intersections within the Deschutes County TSP analysis network

Preliminary signal warrants thresholds were used to rank intersections' deficiencies. Figure 9 shows intersections with different levels of delay from minor approaches. Table 3 summarized intersection locations and their ranking. All of these intersections are in the rural area. For intersections between Deschutes County roadways, roundabouts or additional lane channelizations could improve circulation and reduce delay in the future. For intersections between state highways and Deschutes County roadways, grade separated, additional lanes channelization, or right in – right out options would improve the intersections' function.

Table 3. Intersection Need Ranking

Intersection Locations	Ranking	Entry AADT[1]
Old Bend-Redmond Hwy / US20 (Hwy No. 17)	High	28639
Powell Butte Hwy / US20 (Hwy No. 7)	High	12648
Hamby Rd / US20 (Hwy No. 7)	High	12978
US97 SB On/Off Ramp / Baker Rd	High	13476
Knott Rd / US97 NB Off Ramp / Baker Rd	High	11148
Butler Market Rd / Powell Butte Hwy	High	10385
Hamehook Rd / Deschutes Market Rd	High	10208
Cook Ave / US20 (Hwy No. 17) / O B Riley Rd	High	23474
Neff Rd / Powell Butte Hwy / Alfalfa Market Rd	High	10829
Canal Blvd / SW Helmholtz Way	High	16918
OR126 (Hwy No. 15) / SW Helmholtz Way / NW Helmholtz Way	High	38992
O. Neil Hwy / Pershall Way / US97	High	28168
US97 / Vandevert Rd	High	19772
US97 / Lower Bridge Way	High	23465
South Century Dr / Spring River Rd	High	10026
OR31 (Hwy No. 19) / US97	High	12250
Old Bend-Redmond Hwy / O B Riley Rd	Medium	9859
South Century Dr / Vandevert Rd	Medium	8410
Butler Market Rd / Hamehook Rd	Medium	8533
Coyner Ave / Northwest Way	Medium	7617
US97 / Smith Rock Way	Medium	25437
US20 (Hwy No. 17) / Cloverdale Rd	Medium	11064

[1] AADT estimated from 2030 Deschutes County Model Version dated 07/01/2010.

One important note, an intersection of Sherwood Road and US97 is not included in the study because Sherwood Road is a local county road. However as mentioned under the "Deschutes County Road Segments", Sherwood Road will carry around 13000 vehicles per day, so the intersection of Sherwood Road and US97 will have a high ranking and its entry volumes per day is about 46000.

If you have any comments or questions please contact me at 503-986-4108.

c: Peter Schuytema, TPAU
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File Code:

Date: January 10, 2011

TO: Peter Russell
Deschutes County Planning Division

FROM: Thanh Nguyen, PE, Senior Transportation System Analyst
Transportation Planning Analysis Unit

SUBJECT: Deschutes County Transportation System Plan Update (TSP)
Technical Memo # 4 – Mitigation Alternative Analysis

This technical memorandum summarizes an analysis of proposed alternatives to address deficiencies identified in Technical Memorandum #3, 2030 Future Traffic Conditions. Numerous transportation improvements, including facility upgrades, widenings and road extensions, were considered to address the capacity needs of the motor vehicle. These improvements are summarized in Table 1. Overall, the planning level analysis indicates that these proposed mitigations would improve the efficiency of the transportation system in the future, especially for the state highways. However, a few of the proposed mitigation projects cause increased trips at some intersections and segments, potentially resulting in the need for additional improvements at those locations.

Table 1. Proposed Transportation Improvements

Proposed Mitigation Projects	Project Description
State Highways	
Central Oregon Hwy # 7 (US20): MP 3.01 to MP 3.58	Additional travel lane in each direction
Santiam Hwy #16 (US20): MP 92.76 to MP 99.54	Additional travel lane in each direction
McKenzie-Bend Hwy # 17 (US20): MP 12.26 to MP 13.70	Additional travel lane in each direction
The Dalles-California Hwy # 4 (US97): MP 115.91 to MP 118.53	Additional travel lane in each direction
The Dalles-California Hwy # 4 (US97): MP 151.05 to MP 164.17	Additional travel lane in each direction, disconnect Pinecrest Ln from US97
McKenzie Hwy #15 (OR126): MP 99.90 to MP 101.91	Additional travel lane in each direction
McKenzie Hwy #15 (OR126): MP 107.98 to MP 110.27	Additional travel lane in each direction
Ochoco Hwy #41 (OR126): MP 2.32 to MP 3.62	Additional travel lane in each direction

Proposed Mitigation Projects	Project Description
O'Neil Hwy #370 (OR370): MP 0.40 to MP 0.90	Geometric improvements and access management
Deschutes County Roadways	
Burgess Rd: from Day Rd to Huntington Rd	Add a center left-turn lane
Canal Blvd: from 61st St to Quarry Ave	Add a center left-turn lane
Cline Falls Hwy	Disconnect Nutcracker Dr from Cline Falls Hwy
Helmholtz Wy: from South Canal Blvd to Elkhorn Ave	Add a center left-turn lane
Helmholtz Wy: from Elkhorn Ave to Maple Ave	Add travel lane in each direction and add a center left-turn lane
Northwest Wy: from Pershall Wy to Maple Ave	Add travel lane in each direction and add a center left-turn lane
Intersections	
McKenzie-Bend Hwy # 17 (US20)/ Cook Ave/O.B. Riley Rd	An overpass with jug handles connected to the highway by right-in-right-out (This is the preliminary preferred alternative from the US20/Tumalo Project Development Team)
The Dalles-California Hwy # 4 (US97)/ O'Neil Highway # 370 (OR370)/Pershall Wy	Grade separation by a simple overpass
McKenzie-Bend Hwy # 17 (US20)/Old Bend Redmond Hwy	Grade separation by a simple overpass or a full interchange
Central Oregon Hwy # 7 (US20) / Hamby Rd/Ward Rd	A rural roundabout
Central Oregon Hwy # 7 (US20)/ Powell Butte Hwy	A rural roundabout
The Dalles-California Hwy # 4 (US97)/ Lower Bridge Wy	Grade separation by a simple overpass or a full interchange
The Dalles-California Hwy # 4 (US97)/ Vandevert Rd	Disconnect Vandevert Rd from US97
The Dalles-California Hwy # 4 (US97)/ Fremont Hwy #19 (OR31)	A directional interchange
McKenzie Hwy #15 (OR126)/Helmholtz Wy	Signalized
Butler Market Rd/Powell Butte Hwy	A rural roundabout
Neff Road-Alfalfa Market Rd/Powell Butte Hwy	A rural roundabout
Hamehook Rd/Deschutes Market Rd	A rural roundabout
Canal Blvd/SW Helmholtz Wy	A rural roundabout
South Century Dr/Spring River Rd	A rural roundabout

Travel Demand Model Aspects

Mitigation projects may affect the traffic patterns on the transportation network. In particular, grade separation by a simple overpass or a full interchange (such as a diamond interchange) proposed at the Old Bend-Redmond Highway intersection with the McKenzie-Bend Highway No. 17 (US20) or the Lower Bridge Way intersection with The Dalles-California Highway No. 4 (US97) could greatly affect the traffic patterns on the transportation system plan (TSP) network. The Deschutes County travel demand model was used to study these effects. Two TSP network scenarios were tested with the model to investigate the traffic patterns. Scenario 1 has two simple overpasses at these two locations, while Scenario 2 has two full diamond interchanges.

The full interchange attracts more traffic to the state highways while the simple overpass forces traffic to route to Deschutes County roadways to get to their specific destinations. Comparisons of model Average Annual daily Traffic (AADT) between the scenarios and the baseline (the baseline is the model 2030 no-build network) and between the scenarios themselves, indicates that the simple overpass pushes more traffic off of the state highways onto the local facilities versus the full interchange (See Exhibits 1, 2, and 3). This is apparent especially on US20 between the Old Bend-Redmond Highway and the Bend Urban Growth Boundary, where the simple overpass at the Old Bend-Redmond Highway pushes more than 5,000 trips off of US20 onto O.B. Riley Road versus the full interchange. Also, the simple overpass with right-in-right-out jug handles at the O.B. Riley Road/Cook Avenue intersection with US20 also moves more than 2,500 trips from US20 to O.B. Riley Road.

The future AADT for these proposed mitigations was based on the Deschutes County travel demand model runs (Scenarios 1 and 2). For each scenario, a factor was calculated for each link by dividing the scenario AADT by the future baseline model AADT. Each link's future post-processed AADT (which was used for the analysis in Technical Memorandum #3) was then multiplied by this factor to obtain post-processed 2030 AADT's for each scenario.

Grade Separation Analysis

A grade separation reduces conflict points and provides uninterrupted flows on a roadway segment. However, depending on the type of grade separation, it may or may not be a viable option for the TSP network. There are many factors that need to be assessed before deciding what type of grade separation would bring a sustainable solution for the system. These can include cost, topography, local property impacts, and volumes among others. Grade separations affect the traffic patterns beyond the interchange onto the surrounding area. For example, a full interchange could make the state highways more congested by encouraging local traffic to use the state highways while the simple overpass could make certain county roadways more congested by re-routing local traffic using the Deschutes County roadway network.

1) *A simple overpass or a full interchange at the Lower Bridge Way intersection with US97*:

The travel demand model runs indicated that the traffic volumes would be diverted from one route to another between Scenarios 1 and 2. This makes sense because most drivers want to access state highways at these two intersections. With a simple overpass, these drivers must divert to other local roads that connect to state highways, which can create capacity issues at other locations.

At the Lower Bridge Way intersection with US97, if the full interchange were built instead of the simple overpass, the interchange would attract more trips from other routes such as 31st Street, Ice Avenue, 11th Street, and C Avenue. This would relieve potential capacity issues at Ice Avenue and C Avenue intersections with US97, and Helmholtz Way intersection with Maple Avenue. However, it would create potential capacity issues on US97 between C Avenue and Lower Bridge Way or at Smith Rock Way and A Avenue intersections with US97; or further out to the system such as the OR126/Helmholtz Way intersection, Canal Boulevard intersection with Helmholtz Way, and Quarry Avenue or 61st Street intersections with US97. (See Exhibit 3)

At this point, because data is lacking for a detailed operational analysis, it is difficult to identify which scenario (a simple overpass or a full interchange) would be the best option for this intersection. It is recommended that the simple overpass and the full interchange proposed mitigations for this intersection be studied farther in a refinement plan.

2) *A simple overpass or a full interchange at the Old Bend-Redmond Highway intersection with US20*:

As stated previously, the travel demand model runs indicated that the traffic volumes would be diverted from one route to another between Scenarios 1 and 2. With a simple overpass, these drivers must divert to other local roads that connect to state highways, which can create capacity issues at other locations.

At the Old Bend-Redmond Highway intersection with US20, if the full interchange were built instead of the simple overpass, some of the trips would be diverted to the interchange from Tumalo Road, Gerking Market Road, Connarn Road, and O.B. Riley Road. It also would create a potential capacity issue on US20 from the east side of the interchange to inside the Bend UGB. (See Exhibit 3)

At this point, because data is lacking for a detailed operational analysis, it is difficult to identify which scenario (a simple overpass or a full interchange) would be the best option for this intersection. It is recommended that the simple overpass and the full interchange proposed mitigations for this intersection be studied farther in a refinement plan.

3) *A directional interchange at the Fremont Highway (OR31) intersection with US97:*

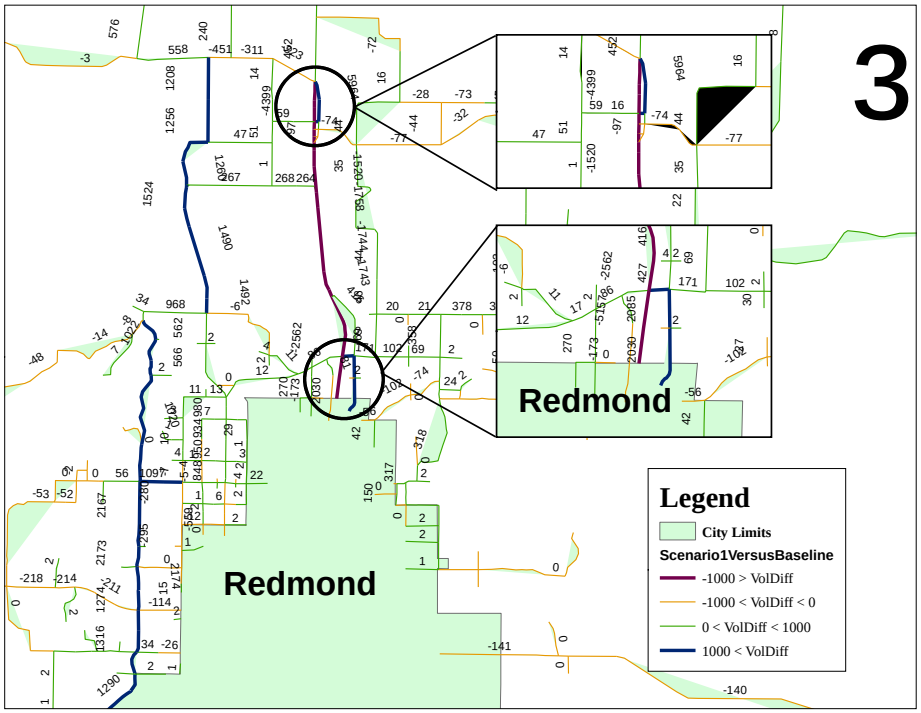
At this intersection, the total entry AADT is about 12,000 vehicles in which only 10 percent would use the directional flyover. The directional interchange would not be an appropriate option for this intersection because of its high cost. This intersection currently does not have any safety issues. The only future issue is the OR31 approach will experience greater delay as US97 traffic increases over time. Currently, this approach only has a single shared left/right lane. The majority of traffic on this approach turns right onto US97 northbound. The greater delay occurs when a vehicle on this approach waits for an acceptable gap to turn left onto U97 southbound. The more US97 traffic increases, the longer this left turn vehicle will have to wait for an acceptable gap. This could create capacity issues on the OR31 approach. A channelized left turn lane on this approach is recommended as a viable project for this intersection. A detailed operational analysis should be studied for its design. However, depending on future strategies for US97 south of City of La Pine that ODOT/Region 4 pursues, the directional interchange at this intersection could be an option for highway to highway movements.

4) *A simple overpass at The Dalles-California Highway # 4(US97) /O'Neil Highway # 370(OR370)/Pershall Way intersection:*

A simple overpass would improve safety at this location by eliminating a direct access to US97. This intersection is only 0.75 mile from the northern interchange in Redmond, so all trips currently accessing the state highway at this intersection could access at the interchange instead. However, this would make some of the trips travel out of direction.

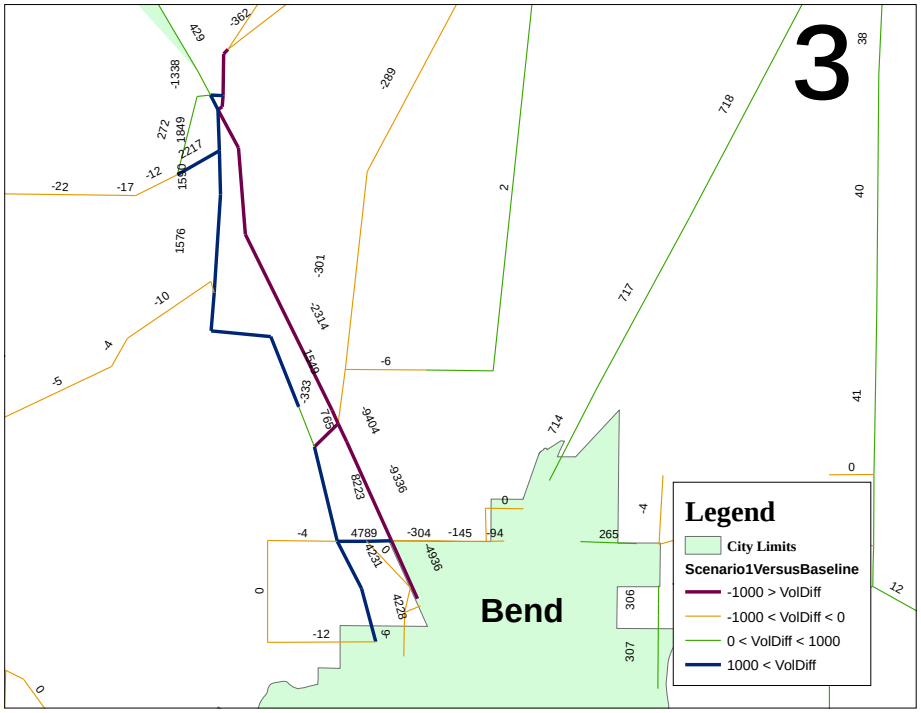
Exhibit 1: Model AADT Differences[1] between Scenario 1 versus Baseline

a) A **s**imple overpass at the Lower Bridge Way and O'Neil Highway # 370 (OR370) intersections with US97



[1] Source: Travel demand model runs (Visum version); Req20100908_Scen2_DCM2030_07_01_10.ver, and Req20100908_Scen1_DCM2030_07_01_10.ver

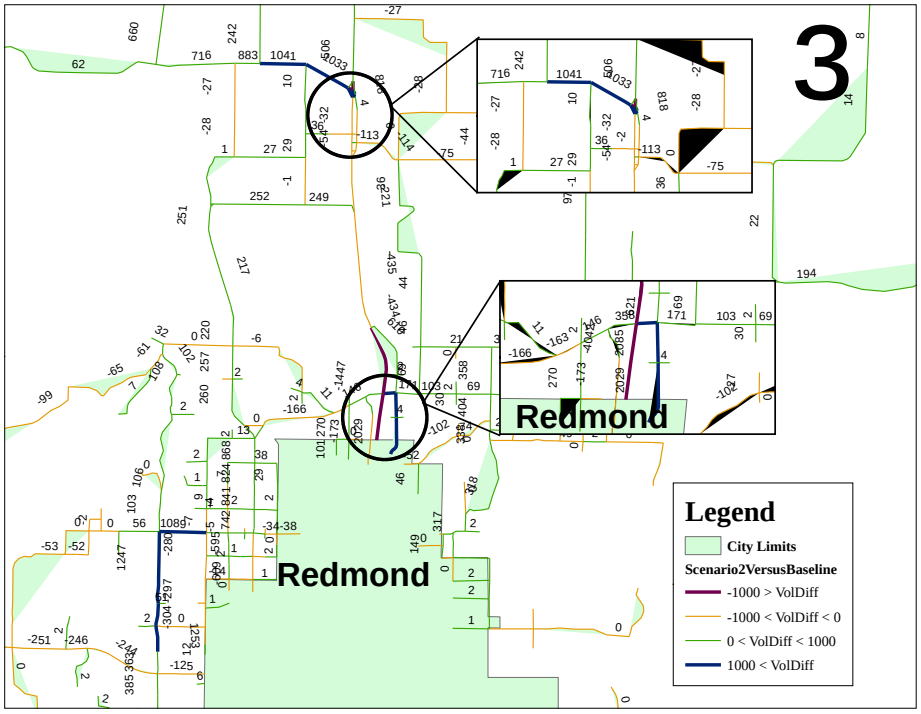
b) A **s**imple overpass at the Old Bend-Redmond Highway intersection with US20 and a simple overpass with right-in-right-out jug handle at O.B. Riley Road and Cook Road intersection with US20.



[1] Source: Travel demand model runs (Visum version); Req20100908_Scen2_DCM2030_07_01_10.ver, and Req20100908_Scen1_DCM2030_07_01_10.ver

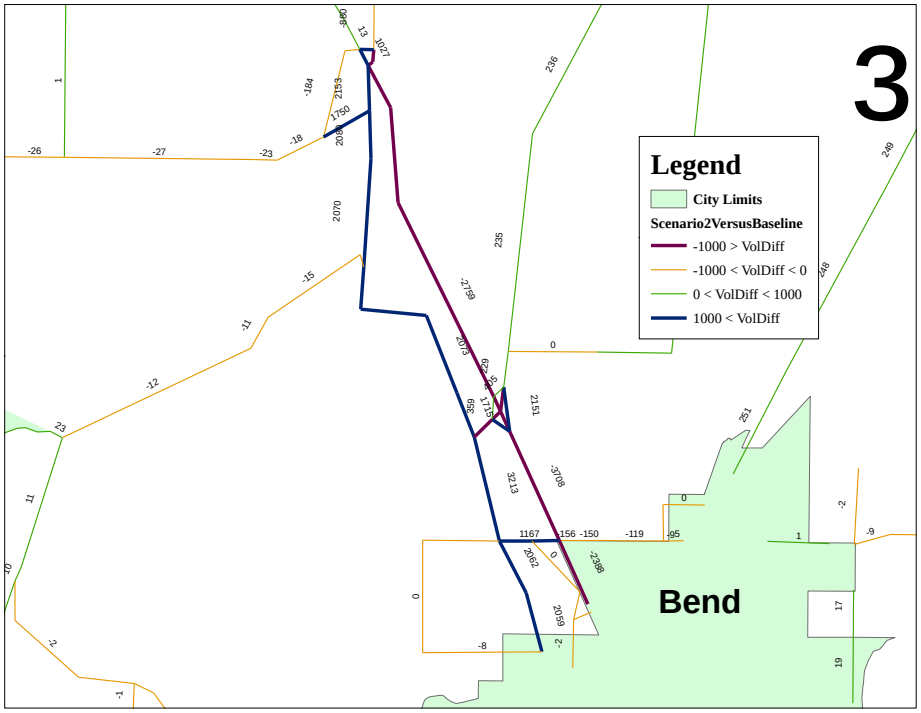
Exhibit 2: Model AADT Differences[1] between Scenario 2 versus Baseline

a) A full interchange at the Lower Bridge Way and O'Neil Highway # 370 (OR370) intersections with US97



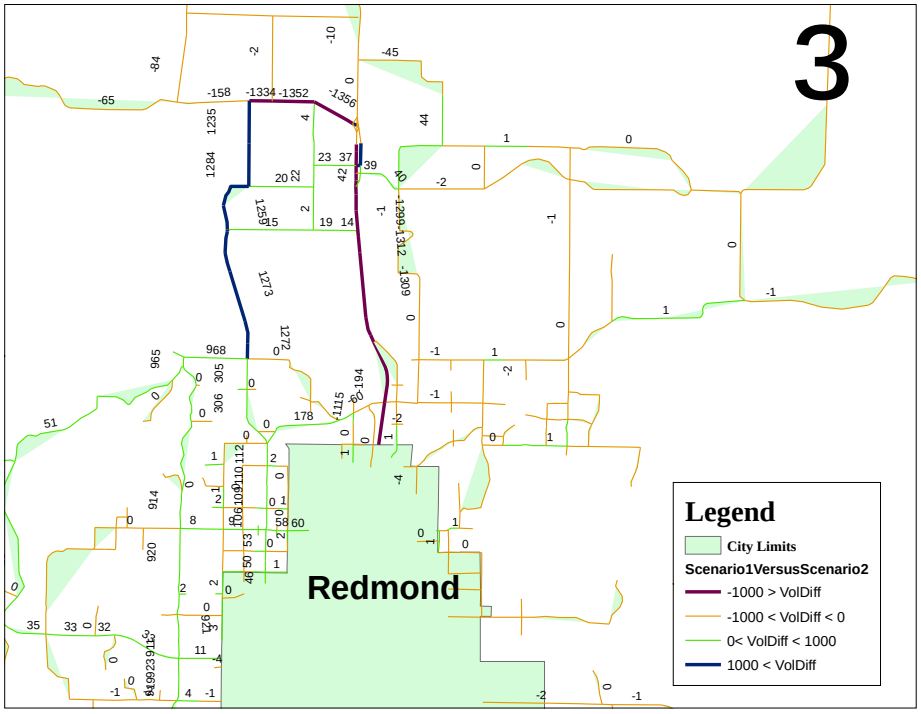
[1] Source: Travel demand model runs (Visum version); Req20100908_Scen2_DCM2030_07_01_10.ver, and Req20100908_Scen1_DCM2030_07_01_10.ver

b) A full interchange at the Old Bend-Redmond Highway intersection with US20 and a simple overpass with right-in-right-out jug handle at O.B. Riley Road and Cook Road intersection with US20.

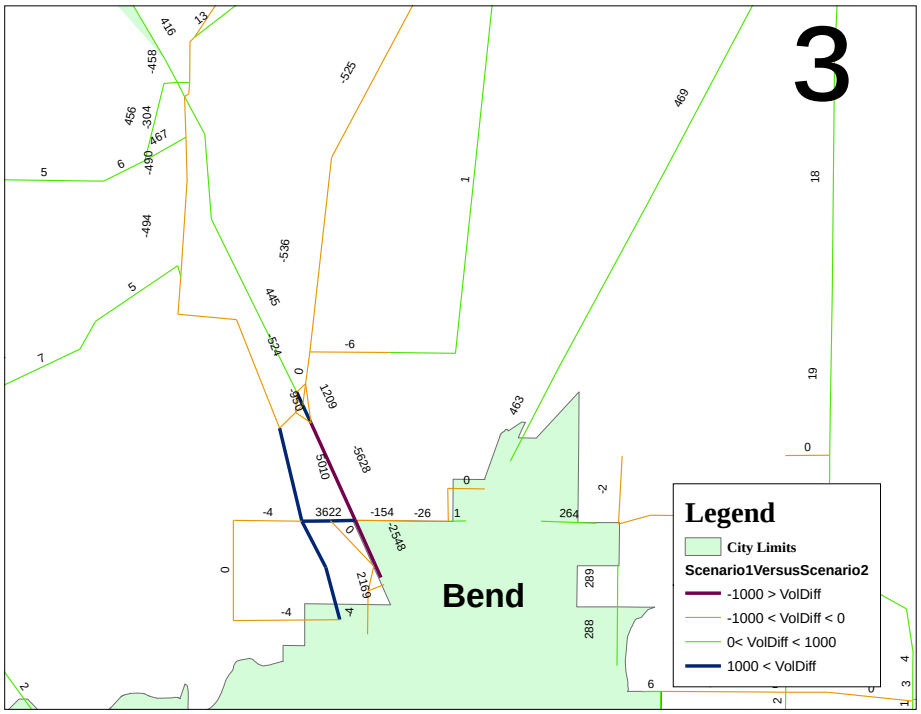


[1] Source: Travel demand model runs (Visum version); Req20100908_Scen2_DCM2030_07_01_10.ver, and Req20100908_Scen1_DCM2030_07_01_10.ver

Exhibit 3: Model AADT Differences[1] between Scenarios 1 and 2



[1] A simple overpass versus a full interchange at the Lower Bridge Way intersection with US97
Source: Travel demand model runs (Visum version); Req20100908_Scen2_DCM2030_07_01_10.ver, and Req20100908_Scen1_DCM2030_07_01_10.ver



[1] A simple overpass versus a full interchange at the Old Bend-Redmond Highway intersection with US20
Source: Travel demand model runs (Visum version); Req20100908_Scen2_DCM2030_07_01_10.ver, and Req20100908_Scen1_DCM2030_07_01_10.ver

Intersections and Segments Analysis

1) *Intersections Analysis:*

Exhibit 4 shows all the intersections that have proposed treatments, needed treatments, and additional operational problems.

a) Roundabouts: Roundabouts were proposed at a few intersections as outlined in Table 1. Table 2 summarizes the entry AADT's at these locations for scenarios 1 and 2. Most of these intersections have the same entry AADT's for scenarios 1 and 2 except Canal Boulevard/Southwest Helmholtz Way intersections. The percentage of left turns is the same between Scenarios 1 & 2 for these intersections.

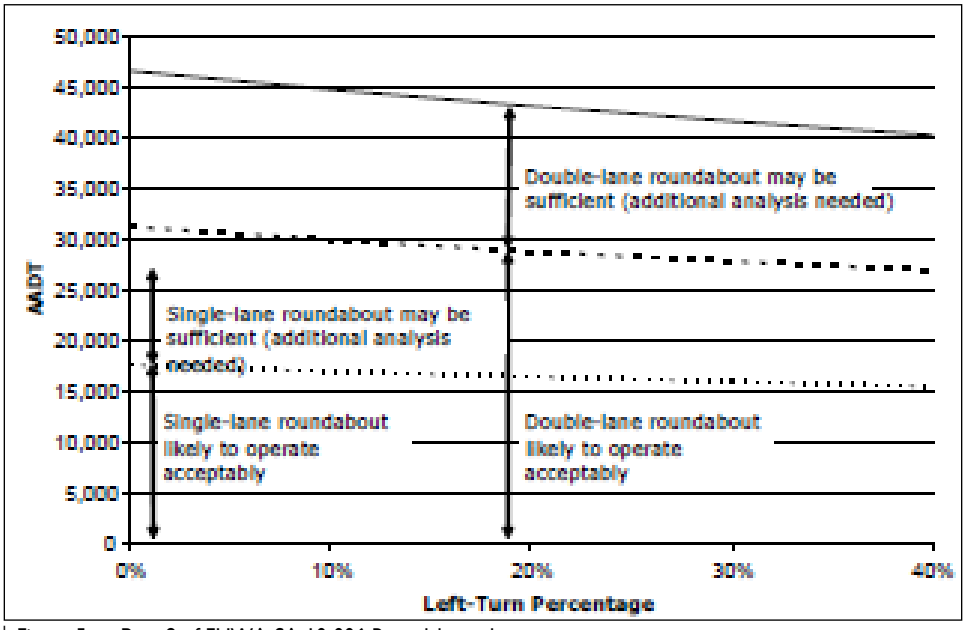
Table 2. Entry AADT's of proposed roundabout intersections

Intersections	Scenario 1		Scenario 2	
	Entry AADT	Left turn[1] %	Entry AADT	Left turn[1] %
Powell Butte Hwy / Central Oregon Hwy	12,650	33	12,650	33
Hamby Rd / Central Oregon Hwy	13,000	8	13,000	8
Butler Market Rd / Powell Butte Hwy	10,400	27	10,400	27
Hamehook Rd / Deschutes Market Rd	10,250	11	10,250	11
Neff Rd / Powell Butte Hwy / Alfalfa Market Rd	10,850	19	10,850	19
Canal Blvd / SW Helmholtz Way	18,050	8	17,050	8
South Century Dr / Spring River Rd	13,900	29	13,900	29

[1] Source: Travel demand model runs (Visum version); Req20100908_Scen2_DCM2030_07_01_10.ver, and Req20100908_Scen1_DCM2030_07_01_10.ver

As a planning level analysis, the Federal Highway Administration (FHWA) has a procedure which is offered as a simple, conservative method for estimating roundabout lane requirements. Exhibit 5 presents ranges of entry AADT thresholds to identify scenarios under which one-lane and two-lane roundabout may perform adequately or more detailed analysis is required. In order to determine number of lanes for a roundabout, draw horizontal and vertical lines associated with the entry AADT and the left turn percentage, and the intersection of these two lines would suggest the number of lanes depending on its location under the curves in Exhibit 5.

Exhibit 5: Roundabout Planning Level Entry AADT Thresholds[1]



[1] Figure 5 on Page 9 of FHWA-SA-10-006 Roundabout document.

http://safety.fhwa.dot.gov/intersection/roundabouts/fhwasa10006/#s5

The entry AADT's at these intersections vary between 10,250 and 18,050 vehicles. The left turn percentages vary between 8% and 33%. Based on Exhibit 5, single lane roundabouts are likely to operate acceptably for these intersections except the Canal Boulevard intersection with SW Helmholtz Way which might need additional analysis.

The Powell Butte Highway and Hamby road intersections with Central Oregon Highways currently have left turn channelizations on Central Oregon Highway. A single lane roundabout would be a potential mitigation for these two intersections. Radii design should be big enough to accommodate large trucks but it should not be too big because cars might improperly overtake trucks that cause the conflicts within the circulating roadway. However, in order to have sustainable mitigations for these two intersections, more data need to be collected and analyzed to address more detail aspects in a refinement plan.

b) Signalization: The McKenzie Highway # 15 (OR126) /Helmholtz Way intersection was proposed to be signalized. The entry AADT at this intersection is 40,150 vehicles and 39,200 vehicles for Scenario 1 and Scenario 2 respectively. For the purpose of planning analysis, the entry AADT of 40,150 which provides a worse case would be used for the analysis. As a planning level analysis, the entry AADT of each approach was converted to peak hour turn movement volumes by using a K factor assumption of 10 percent and the travel demand model AADT turn factors. Then the turn volumes were input into the Highway Capacity software with an assumption that all approaches would have an exclusive right and left turn lane and permitted left turn signal phasing. The signal would operate acceptably with a

planning v/c ratio of 0.67. However, detailed analysis should be performed for its specific design.

c) Additional caveats for intersections on County roadways: The proposed grade separations on McKenzie-Bend Highway # 17 (US20) at the Old Bend-Redmond Highway and Cook Avenue/O.B. Riley intersections would result in two additional County intersections to need mitigation because of rerouting traffic. A single lane roundabout would be a potential solution for these two intersections. The two intersections which need improvements are the Old Bend-Redmond Highway/O.B Riley Road and O.B Riley Road/Cooley Road. These two intersections did not show up as a high need for improvements in Technical Memorandum 3. The grade separations cause more traffic to be rerouted to O.B. Riley Road. Any minor approaches that are connected to O.B Riley Road would experience longer delays or operational problems. Table 3 summarizes their entry AADT's in each scenario.

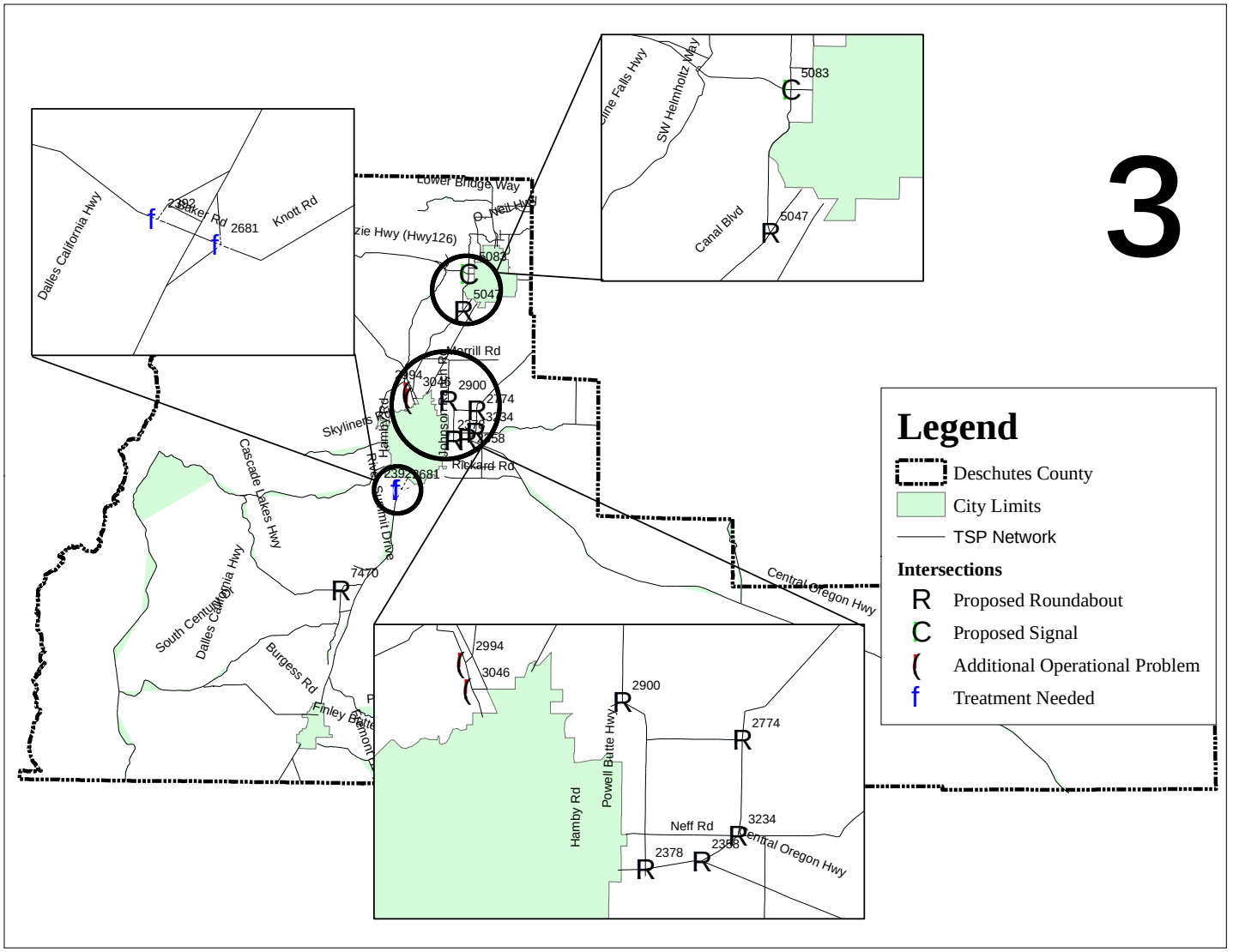
These intersections were evaluated against the preliminary signal warrants. ODOT's Preliminary Signal Warrant (PSW) is used to evaluate signalization at an ADT level for an unsignalized intersection. Meeting the warrant does not mean a signal will be installed, but it indicates that the minor approaches will experience excessive delay or have substantial difficulty in entering or crossing the major street at an unsignalized intersection. As a part of the system analysis for the TSP, the PSW process was used to rank unsignalized intersections based on the approach's ADT volumes. Exceeding certain thresholds could indicate when an intersection improvement (not just including signals – i.e., roundabouts, turn restrictions, interchanges, etc.) would be necessary. Because of the sensitivity of the model volumes and the normal fluctuations in volumes, the following warrant thresholds to rank deficiency were used:

- Between 60% and 80% of threshold: Low risk
- Between 80% and 100% of threshold: Medium risk
- Greater than 100% of threshold: High risk

Table 3. Additional Intersections Needing Mitigation

Intersections	Entry AADT	
	Scenario 1	**Scenario 2**
Old Bend-Redmond Hwy / O B Riley Rd	13,400	11,400
O B Riley Rd / Cooley Rd	14,850	9,450

Exhibit 4: Intersections



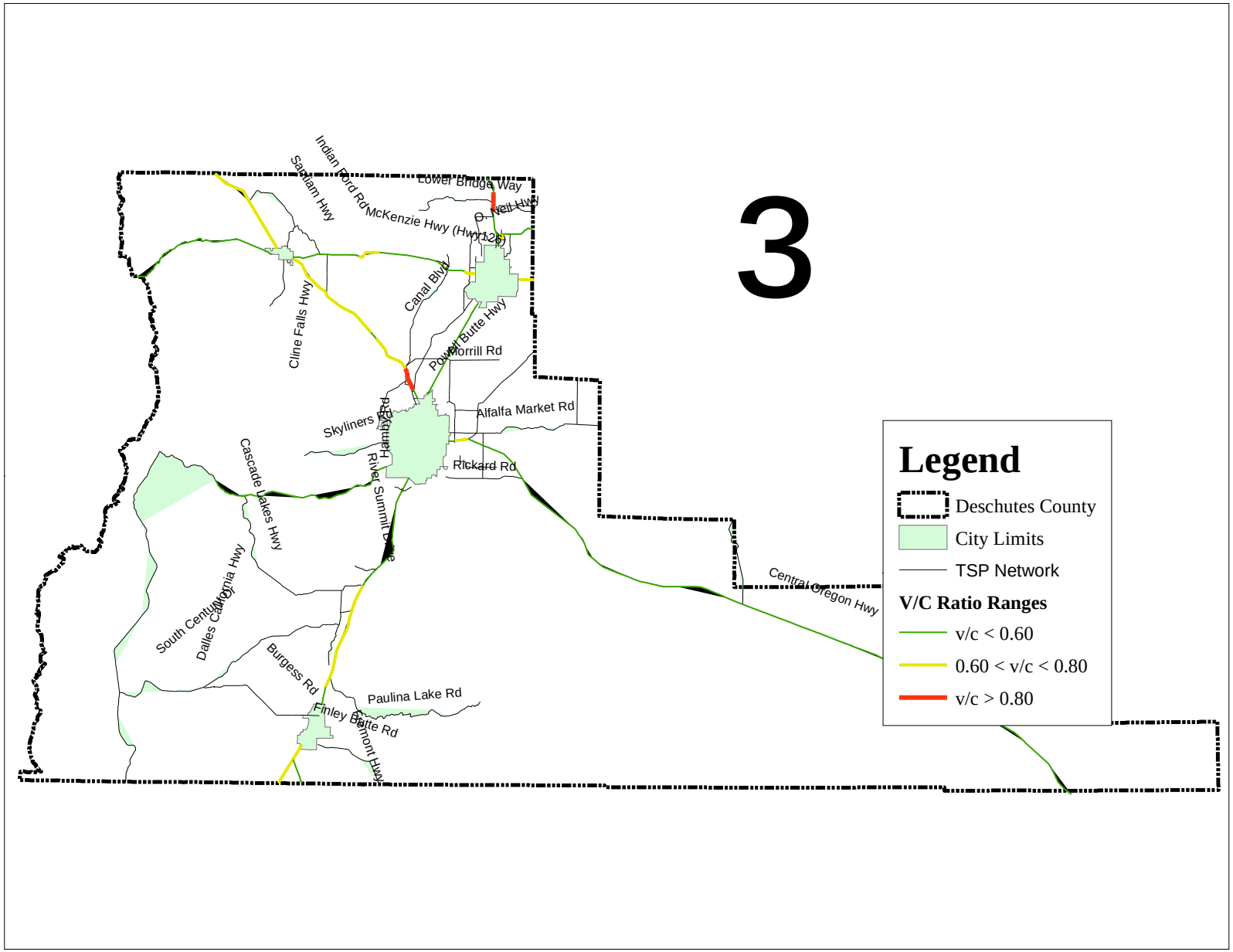
2) *State Highway Segments:*

At the planning level, state highway segments should be evaluated based on a range of acceptable volume to capacity ratios (v/c) between 0.60 and 0.80 (based on engineering judgment). For Scenarios 1 and 2, the state highway segments planning v/c ratios were calculated for proposed mitigations (as outlined in Table 1) on state highways by HERS-ST (Highway Economic Requirements System – State Version). The AADT's on state highways do not vary that much (mostly less than 10%) between both scenarios except one segment on US20 between Old Bend-Redmond Highway and the City of Bend urban growth boundary. The review of planning v/c ratios of proposed mitigations of two scenarios on state highways as tested against the range of the acceptable v/c ratios indicates that those proposed mitigations would operate acceptably. However, two segments are still in need for improvements for both scenarios.

One segment is on McKenzie-Bend Highway # 17 (US20) between milepoints 14.57 and 16.58. This segment has two travel lanes in one direction and one travel lane in the opposite direction. Its planning v/c ratio for the direction that has one travel lane is 0.84. The roadway curvature highly affects its operation. However, there is a contingent project at the McKenzie-Bend Highway # 17 (US20)/Cook Avenue/O.B. Riley intersection, so its recommended treatment may be proposed from that project.

Another segment is on The Dalles-California Highway # 4 (US97) between milepoints 114.24 and 115.91 around Lower Bridge Way. This segment has an AADT of about 20,000, one travel lane in each direction at lower speed and multiple access points. This segment should be studied further in a refinement plan. Exhibit 6 shows ranges of v/c ratios on state highways for Scenarios 1 and 2.

Exhibit 6: Scenarios 1 and 2 V/C Ratio[1] Ranges on State Highways



[1] V/C ratios were calculated by HERS-ST

3) *Deschutes County Segments:*

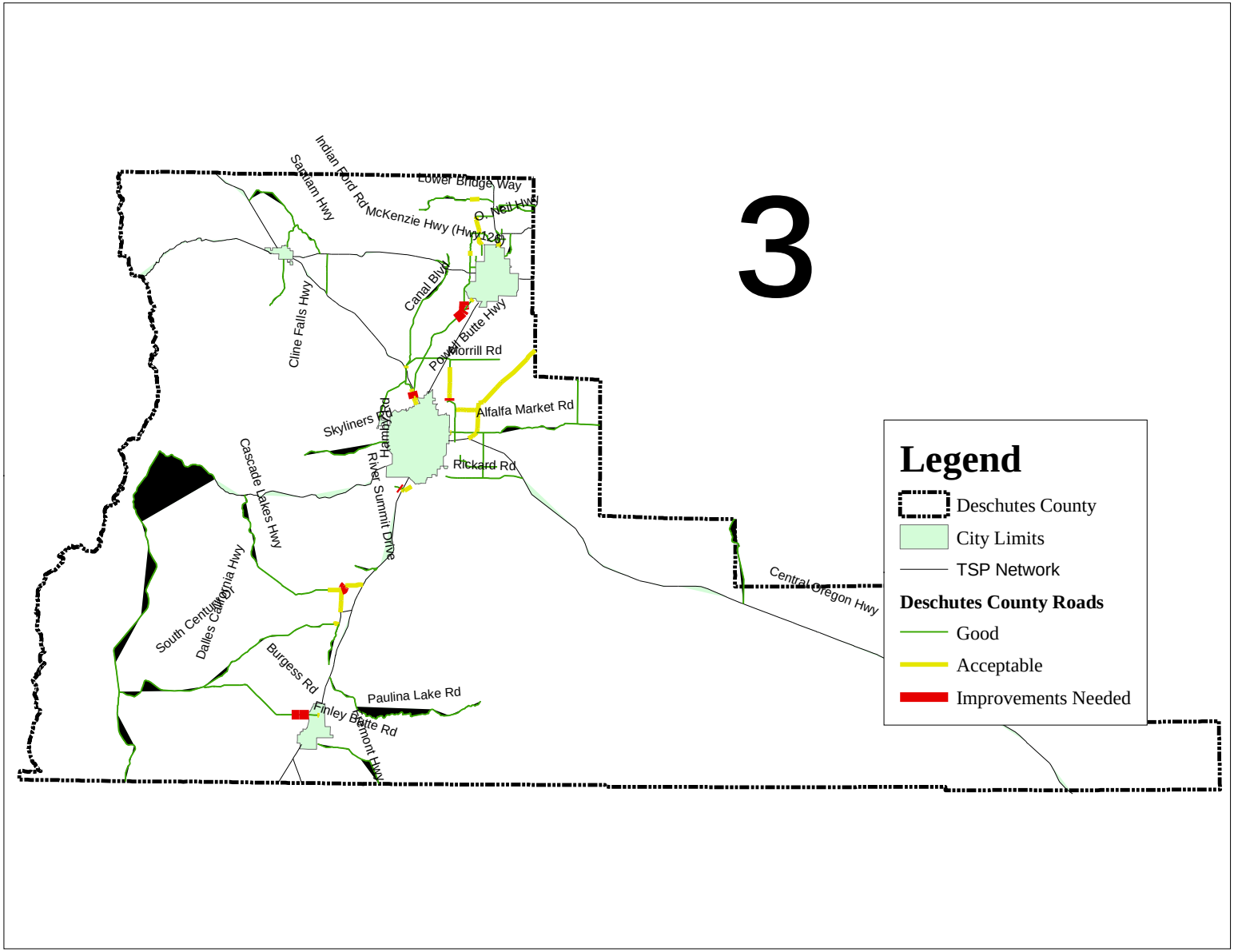
Most of Deschutes County roadway segments operate within the County's acceptable operational measures in Scenarios 1 and 2 (See Exhibit 7). However, there are a few segments that need attention, as discussed below.

a) Additional travel lane in each direction: Currently, the County defines Level of Service (LOS) D with a range of AADT between 5,700 and 9,600 vehicles as acceptable for County Roads. However, this is only applicable to two lane roadways. For a four-lane roadway, the range of AADT for LOS D will be higher.

Based on the Highway Capacity Manual, with an assumption of the proportion of AADT during peak hour (K) of 10 percent, a directional proportion of 55 percent, a truck percentage of 10 percent, a base free-low speed of 55 mile per hour, and rolling terrain type, the range of AADT for LOS D for a four lane roadway would be between 32,800 and 42,900 vehicles. The proposed mitigations of adding travel lane in each direction works well for the Helmholtz Way segment between Elkhorn Avenue and Maple Avenue, and for the Northwest Way segment between Pershall Way and Maple Avenue. Their post-processed 2030 AADTs vary between 13,200 and 21,000 vehicles on the Helmholtz Way segment and between 11,300 and 18,700 vehicles on the Northwest Way segment.

b) Adding a center turn lane: There are three segments proposed to add a center turn lane (a third lane) as described in Table 1; Burgess Road (2030 AADT = 11,000), Canal Boulevard (2030 AADT = 16,600), and Helmholtz Way (2030 AADT = 14,350). These segments would be called two-way median left-turn lane (TWLTL). The County does not define LOS for this type of roadway. When evaluating these TWLTL's post processed 2030 AADTs against the current County's acceptable LOS D, these segments show a need for improvements. However, on two-lane roadways having sizable left-turn traffic, a single travel lane in each direction often experiences long delays as vehicles await to turn left. By providing a center turn lane, the two-way left-turn lane can help to maintain through traffic capacity.

Exhibit 7: Scenarios 1 and 2 Deschutes County Roadways



c) Additional caveats for segments on County roadways: Because of proposed mitigations, some additional County roadways need improvements in Scenarios 1 and 2 when evaluating their post-processed 2030 AADTs against the current County's acceptable LOS D. These additional segments include Deschutes Market Road between Margaret Lane and Hamehook Road, South Century Drive between Spring River Road and Abbot Drive, and O.B. Riley Road between Destiny Court and Cooley Road. An additional travel lane in each direction for these segments would be favorable. Table 4 summarizes their AADT's along with LOS.

For the Deschutes Market Road segment between Margaret Lane and Hamehook Road, the City of Bend will extend Cooley Road to Deschutes Market Road somewhere between Margaret Lane and Hamehook Road in its Metropolitan Transportation Plan. This will allow an additional east-west connection between commercial areas along US97 and residential areas to the east.

The South Century Drive segment between Spring River Road and Abbot Drive, was shown to operate acceptably in Technical Memorandum 3. However, the proposed mitigation of disconnecting Vandevert Road from US97 reroutes Vandevert Road traffic to South Century Drive and causes this segment to have an operational problem.

The O.B Riley Road between Destiny Court and Cooley Road operates acceptably in Technical Memorandum 3. However, the proposed grade separations on US20 at the Old Bend-Redmond Highway intersection and at the O.B. Riley Road/Cook Road intersection cause more traffic on O.B Riley Road (See Exhibits 1 & 2). This causes O.B. Riley road to have an operational problem.

Table 4. Additional Segments

Segment or Roadway Name	From	To	AADT[1]	LOS
Deschutes Market Road	Margaret Lane	Hamehook Road	10,700	E
South Century Drive	Spring River Road	Abbot Drive	12,700	E
O.B Riley Road (Scenario 2 only)	Destiny Court	Old Bend – Redmond Highway	9,750	E
O.B Riley Road (Scenario 1 only)	Old Bend-Redmond Highway	Cooley Road	13,050	E

[1] AADT estimated from Req20100908 _ 2030 Deschutes County Model Runs Version for Scenarios 1 and 2

If you have any comments or questions please contact me at 503-986-4108.

cc: Peter Schuytema, TPAU
James Bryant, Region 4
Mark Devoney, Region 4
File

APPENDIX C – DESCHUTES COUNTY CODE TABLE A

APPENDIX D – OREGON HIGHWAY PLAN ACCESS SPACING STANDARDS

See "OHP Access Management Revisions Appendix C – final review draft"

http://cms.oregon.egov.com/ODOT/TD/TP/pages/ohp_am.aspx

APPENDIX E – DESCHUTES COUNTY ROAD DEPARTMENT REPORTS

http://www.deschutes.org/Road/Maps-and-GIS/Road-Reports.aspx